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Advancing health promotion theory: Case study of physical activity in the school food garden

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ADVANCING HEALTH PROMOTION THEORY:
CASE STUDY OF PHYSICAL ACTIVITY IN THE SCHOOL FOOD GARDEN

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Certification

I Belinda Gay Giles, declare that this thesis submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Health and Society, Faculty of Social Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Belinda Gay Giles

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ABSTRACT

This thesis examines an established school setting initiative for its potential to increase physical activity and inform the further development of Health Promotion theory. It addresses two related research questions:

1. Do food gardens in schools have the potential to increase physical activity?

2. What advances to school setting Health Promotion theory can be made using structuration and institutional development approaches?

A Mixed Methods case study was conducted using the methods of accelerometery, ethnographic observation, qualitative observation of video and time-lapse photography and interview data analysed thematically. Empirical data informed development of a concept of physical activity from a Health Promotion perspective and two theoretical models.

Previous studies of food gardens in schools have reported changes in physical activity with the introduction of a garden program; a need remained to describe the physical activity of garden sessions and make comparisons across alternative school day sessions. This study confirmed that school food gardens are a site for physical activity and the physical activity of garden sessions varies. Three potentials for school food gardens to increase physical activity were identified: regular attendance; timetabling sessions to avoid high activity break times; and regulating the relative length of session duration for garden and kitchen components of the program.

The study identified the variability between schools of garden sessions, especially in the comparison of garden sessions to the other school day segments. Local measures to increase physical activity from garden programs are evident but generalisations across school sites are not recommended. The importance of light intensity activity of 3-4 MET to total volume of physical activity was identified and it was noted a significant volume of movement goes unrecognised because of assumptions about intensity and its relationship to health outcomes.

Two visual data studies were conducted in order to contextualise the observations of the accelerometery study. The qualitative observation of video images of the garden sessions and time lapse photography of the garden at other times led to the

conceptualising of a physical activity for Health Promotion perspective. Seven contextual factors were identified: transience, biophysical, social dynamics, time course, adult presence, purpose and physical autonomy. Conceptual elements were developed from these factors. They include a focus on subjectivity, normalised biophysical diversity, recognition of unintended consequences, a human development time course, purpose, a recognition of net health outcomes and the sanctity of physical autonomy. This thesis proposes that the pledges of the Ottawa Charter communicate a Health Promotion ethic; they are used in the theoretical developments to ensure the integrity of the Health Promotion perspective is retained.

The first research question is answered in the affirmative. Food gardens in schools have the potential to increase physical activity.

The second half of this thesis continued to explore the empirical data to develop school setting Health Promotion theory using structuration and institutional development concepts. Qualitative interview methods explored subjective connections between the garden, physical activity and school setting health. Interviews with students, volunteers, school teachers and program staff, were thematically analysed identifying three participant identified health outcome types (PIOTs) of garden physical activity. These were described as Physiological, Contingent and Consequent outcomes. The Structuration Links Model was created to propose relationships between these PIOTs.

The Structuration Links Model is a duality cycle model that unifies, over the passage of time, the agentic actions of daily life and the influence of social structures. The unique geometry of the model relates time- and space-distant settings health outcomes with the momentary duality of agency and structure observable in interactions of garden physical activity. The foundation of social structuring is represented as an outcome of bodily action and the reflexive cognition of subjective rationalities. These social structuring processes perpetuate and the model represents the production and reproduction of structure from agency and agency from structure. With the application of the Structuration Links Model, social health can be modelled from the activity of daily life in an institutional setting. The Structuration Links Model is a component theory of the ReInterplay Model, the second theoretical advance in setting Health Promotion to emerge from this case study.

The ReInterplay Model is a multi-level, multi-institutional theory created by extending and remodelling the components of an existing theoretical proposition (Rütten & Gelius, 2011). The model is described as a virtual environment to facilitate its accessibility and eventual use in collaboration with community members. The ReInterplay Model incorporates the Structuration Links Model with the multi-levelled Institutional Development and Analysis Framework (Ostrom, 2005) through the concepts of structuration's 'underlying codes' and 'surface manifestations' (Giddens, 1984). Units from the Structuration Link Model equate with structuration's 'underlying codes' in a micro level view while interactions cycles of the IAD framework levels were imagined as structuration's 'surface manifestations' in the macro level view. The repeated 'surface manifestation' cycles create multiple units of Structuration Links that, because of their spatial relationship in the setting, enmeshed to form a fabric of action-outcome linkages. In this way the subjective rationalities of community members, specifically their reflexive cognitions regarding physical activity and health, are represented as constituting the fundamental fabric of social settings and institutions.

The model represents an advance in Health Promotion theory that has immediate applications in school settings policy and change agendas. The thesis concludes with a discussion of optimising the local unintended health outcomes of settings initiatives and pathways to transition established school Health Promotion initiatives into the ideal and notional form of the Health Promoting School. With further work, even wider applications could be discovered in health services, government services and private settings for this multi-level metaphor. Structuration and institutional development were found to be theoretical approaches able to relate physical activity to the processes creating health-promoting settings.

Food gardens in schools have potentials to increase physical activity. The Structuration Links Model and ReInterplay Model are advances to school setting Health Promotion theory that have been made using structuration and institutional development approaches.

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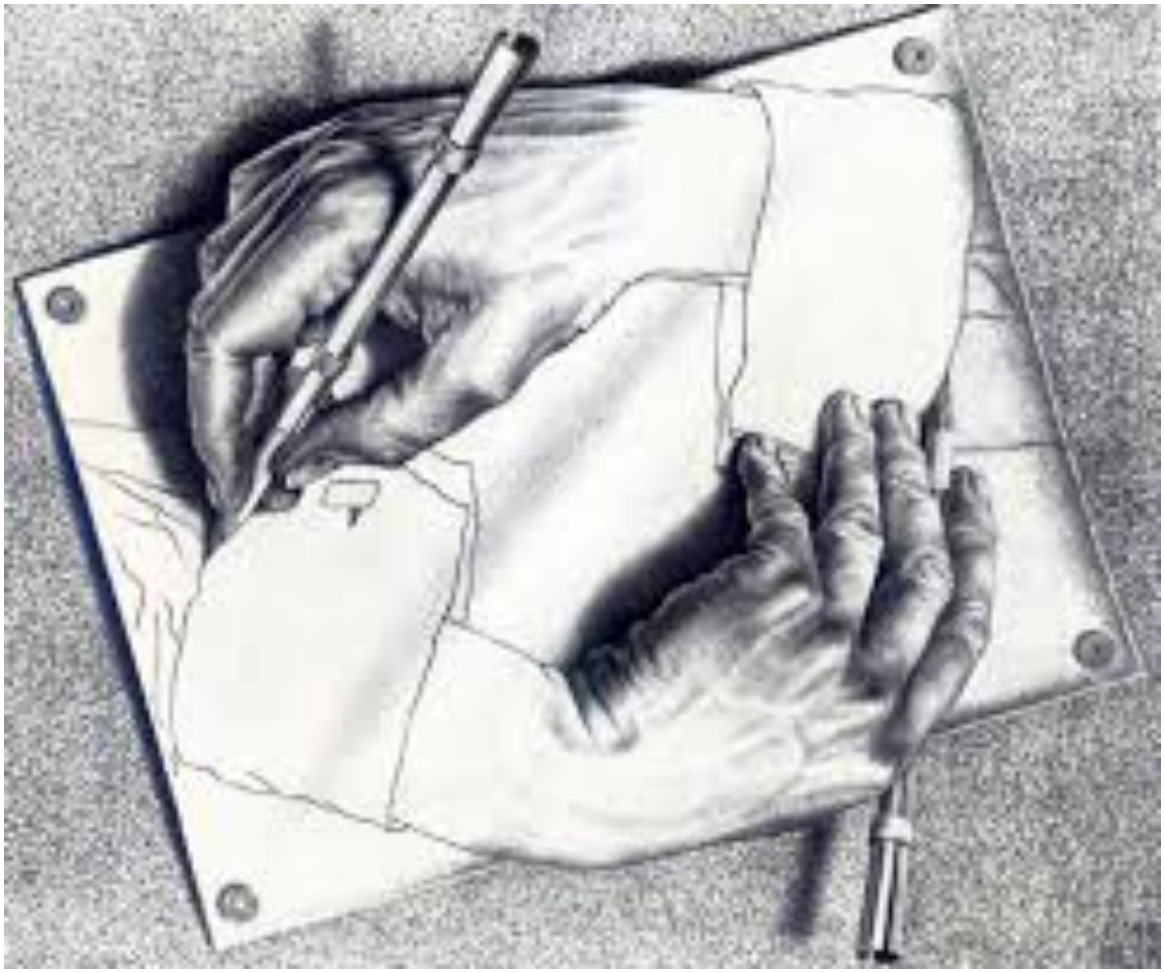
To my extraordinary family, my Groovers, you are my reason. Benefits to you are my lasting value; work of lasting value is to benefit you. Thank you for this beautiful life.



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1 INTRODUCTION

1.1 Introduction

This thesis examines an established school setting initiative for its potential to increase physical activity and inform the further development of Health Promotion theory. It describes the physical activity of school food gardens and critiques methods used to measure the health outcomes of garden physical activity. The concept of physical activity from a Health Promotion perspective is explored. This thesis typifies the health outcomes of garden physical activity identified by participants developing a model that relates these outcomes to the process of structuring in the school setting. A structuration and institutional development approach to Health Promotion theory is explored in the school setting through the further development of a theoretical proposition first offered by Rütten and Gelius (2011). The remodelled theory is used to hypothesise transition of established Health Promotion initiatives in schools to the more structural form of the Health Promoting School (HPS).

School settings possess a finite capacity for adding whole new Health Promotion initiatives. Even funded initiatives challenge a school's financial (Eckermann, Dawber, Yeatman, Quinsey, & Morris, 2014, p.40) and human resources (Hazzard, Moreno, Beall, & Zidenberg-Cherr, 2012). However, school health promotion can remain responsive to the many pressing health issues emerging in school communities by developing and cultivating more and diverse health outcomes within existing initiatives. The process of encouraging identification of under-recognised (even unintended) outcomes from programs and optimising their local effects may itself enable further structuring of school settings and provide them with a greater capacity for Health Promotion.

A particular kind of theoretical model is needed to recognise Health Promotion outcomes in a school setting and promote progress toward the Health Promoting School (World Health Organization, 1995b) – the archetype expression of healthy school settings. It is important for the on going development of the discipline to maintain a Health Promotion perspective on health outcomes. This thesis turns to the pledges of the Ottawa Charter for Health Promotion (WHO, 1986) to provide the defining ethic of the

Health Promotion perspective. Use of the pledges in this way ensures the nominal "Health Promotion perspective" is reserved for concepts that are consistent with the significant, consultative history of the discipline. The theoretical proposition of Rütten and Gelius (2011) shows promise for such a purpose, if further developed and adapted for school setting use.

The process of advancing theoretical understanding strengthens both the practice and the discipline of Health Promotion (Potvin, Gendron, Bilodeau, & Chabot, 2005). Many school initiatives are atheoretical and do not fully characterise the ethic of Health Promotion. Instead they focus on a purposive subset of strategies and actions within the limits of an approach. They intervene. They try to influence outcomes that have not been conceptualised in the context of the prerequisites of health or a holistic consideration of the Health Promotion ethic. Revisiting established Health Promotion initiatives to address their theoretical omissions offers the opportunity to foster their program outcomes while strengthening our understanding of what constitutes the discipline of Health Promotion.

Revisiting initiatives can provide mature insights into the social dynamics of established initiatives in settings, made after the pragmatic compromises of program implementation and concessions to ensure sustainability. It is an approach that enables a deeper interrogation of methods and methodologies of practice and allows contemplation of how they relate to the theories of the discipline. Investigating existing initiatives to develop a uniquely Health Promotion theoretical understanding is imperative if the practice of Health Promotion is to mature and the discipline of Health Promotion is to continue to emerge (McQueen et al., 2007).

The study that follows revisits school food gardening initiatives. Modern school food gardening is diversifying from its primary food education outcomes (Block et al., 2012; Dyment & Bell, 2008) and is now suggested to have the potential to increase physical activity (Wells, Myers, & Henderson, 2014; Yeatman et al., 2012). This mixed methods case study examines school food gardening as an established Health Promotion initiative, revisited to explore its potential to diversify and additionally to realise physical activity outcomes as they are understood from a Health Promotion perspective. The underlying goal is to explore the relationship of Health Promotion method,

methodology and theory in achieving this purpose. This is in order to inform development of Health Promotion theory that is understandable to Health Promotion professionals and community members. An application of such theory should enable communities and Health Promotion professionals to model ways in which Health Promoting Schools might emerge as settings.

Consequently, the first aim of this study is to identify the potential of school food gardening to increase physical activity. Revisiting established school food gardens enables investigation of this potential and whether any opportunities to realise it exists in the schools. It also enables critique, from a Health Promotion perspective, of the methods used to determine the health outcomes of garden physical activity and the relationship these health outcomes may have to structuring of the school setting.

The second aim of this study is to explore what value a structuration and institutional development approach has in advancing Health Promotion theory in a school setting. The combination of these approaches was suggested by the work of Rütten and Gelius (2011) due to their shared focus on activity of daily life and action orientation. The decision was taken to continue work extending this interesting social theory as it had already shown explanatory power for physical activity in a community setting.

Structuration theory was proposed by Anthony Giddens (1984) in an attempt to resolve structuralist and individualistic approaches in social science. His resolution was to propose a process approach, one that describes an interdependent and mutually reinforcing duality of structure and human agency. Time is a fundamental consideration in such a process approach and Giddens (1984) places an emphasis on the largely unconscious motives of the actions of daily life and the ubiquity of reflexive monitoring of interaction situations. Consequently, Structuration theory uses the concept of boundaries in time-space relationships in understanding human societies (Giddens, 1984). Turner (1986, p 973) explains these boundary relationships establish and reinforce an ontological security that drives agents to reproduce routinized and regionalized interactions thus creating bounded situations in which the contingencies and consequences of social interactions can be understood.

The Institutional Analysis and Development Framework (IAD) (Ostrom, 2005) shares structuration theory's focus on actions of everyday life (Rütten & Gelius, 2011). The

IAD framework (Ostrom, 1999) is a model of structural variable types, termed holons, common in type across institutions. The framework is a multi-level arrangement of holons replicated in their layout at each level of the modeled institution- operational, collective-choice, constitutional and meta-constitutional situation levels. Different holons are found to be present in unique relationships of influence within and between levels of institutions. It is the patterns of interactions between actors in setting situations, influencing and influenced by these holon arrangements, that are the focus of institutional analysis using this framework (Ostrom, 2005).

Identification of the pivotal 'action arena' holon is the first task of analysis (Ostrom, 1999, p 28). The analytical process goes on to explore factors that affect the structure of the action arena. The analysis proceeds from the identification of patterns of interactions in the action arena to a description of their outcomes, evaluated by applying particular criteria connected to, or expressed in, the setting. The influence of outcomes is then translated to other holons within the level or translated to holons and/or action arenas on other levels. The other holons involved in these influencing relationships include Biophysical /Material Conditions, Attributes of Community and Rules in Use. Analysis of an institution by the IAD relates multiple action arenas at different levels. These may be linked sequentially or simultaneously.

Emphasis in application of the framework is approached differently by different academic disciplines to achieve distinctive aims (Ostrom, 1999, p 24-30). One approach is to focus on the nature of the influence specific holons bring to bear on interactions in an action arena of known structure. Alternatively, investigators may take an approach that focuses on the holons themselves and their effect on action arena interactions. Finally, for the purposes of this thesis, the focus may remain on the nature of the interactions and ways in which the holons and influence on or by them, might be altered. This study will incorporate elements of all three approaches.

This study begins with an examination of the influence of an Evaluative Criteria holon, specifically exploring concepts by which physical activity is, and may be, evaluated in interactions of a school food garden. It then takes the alternate approach using the visual study methods to explore ways in which rules in use, the physical world, and attributes of a school community reflect and determine the patterns of interactions of setting

individuals. This approach continues with the interview methods that focus on the nature of participant identified outcomes of the school food garden and their relationship to the physical activity of interactions in the action arena. The final approach is that taken in the processes of theoretical development that conclude this thesis. Theoretical development is undertaken to provide school community with a conceptual tool with which to model their school setting and communicate within that view the central place of their interactions in the provision of explanatory power.

The intention of exploration of structuration and institutional development approaches is to create an accessible model that will support the process of a community hypothesising design and transition to a HPS setting. To achieve this, participant identified health outcomes of food garden physical activity will be typified and modelled for integration with other component theories from Rütten and Gelius's (2011) theoretical proposition.

While prediction and replicability feature as criteria for successful theoretical development from a positivist position, it is explanatory power that is the goal of social theory adopted in arguing this thesis. Theoretical development from the position of structuration is a process producing a glossary of concepts, in draft arrangement, using a language that empowers community members to understand and explicate their reality reflexively and communicate their intentions. This position of structuration theorists (Giddens, 1984; Rütten & Gelius, 2011; Turner, 1986) is in keeping with Ostrom's (1999) warning of 'weak inferences' (p.33) in open, less constrained field situations.

A critique of Giddens's structuration theory published by Turner (1986) in the American Journal of Sociology provides insight into this necessarily explanatory characteristic of social theory. Turner (1986) writes in an opening statement about *The Constitution of Society* (Giddens, 1984):

"At the core of Giddens's work is his renouncement of positivism, especially of theory that seeks to develop timeless laws of human organization (pp. 334-54; see also 1976, 1979). This rejection of positivism stems from a conviction that patterns of human organization are changeable by human agency and therefore cannot evidence invariant properties. Indeed, the generalizations of science can be used by lay actors to alter the social reality depicted by such generalizations, thereby obviating their relevance for

understanding this reality. According to Giddens, the best that social theory can offer is a series of "sensitizing concepts" that alert investigators to processes among active human agents." (Turner, 1986, p969)

This thesis approaches the component theories identified by Rütten and Gelius (2011), and their elements, as such "sensitizing concepts". In accordance with the above description of structuration theory, the power of agency manifests in a person when they hold their understanding of reality above invariant properties of theory asserted by another. This thesis takes the position that the very agency of community members is dependent on their power to direct the inclusion or exclusion of specific theoretical elements and control the arrangement and relationships between them.

Elinor Ostrom (1999) offers to investigators a caution to avoid the false belief that sensitivity by setting participants is all that is necessary to effect institutional change (p. 33). She acknowledges that models for use with communities have a weakened capacity for making inference from. A large range of strategies may be employed by independent, autonomous individuals embedded in communities, exhibiting norms of fairness and conservation (p. 33). People may be observed adapting their strategies over time in response to learning or perhaps, in the case of those prosocial norms, the observation of unintended or inequitable outcomes. She writes that more open, less-constrained situations make weaker predictions from patterns of outcomes, however, also notes that increased joint outcomes result from laboratory situations that create communications through a common-pool situation. In her words:

"In field settings, one cannot just assume that helping individuals engage in face-to-face discussions in a few meetings will increase the probability of improved outcomes. There are many factors that affect the likelihood of successful long-term governance of resources."

This thesis aims to investigate advances to school setting Health Promotion theory that can be made to help individuals successfully engage in a process to improve health outcomes using structuration and institutional development approaches.

It follows that the role of the Health Promotion theorist is to make an offering to communities that provides a glossary of "sensitizing concepts", arranged in such a way that a selection of these concepts can be seized by the community to explicate their

patterns of human organisation and potentially inform their process of change. Accordingly, the highest theoretical offering an investigator can propose to members of a community is a conceptual draft for adaptation by that setting community. Any suggestion that a social theory has empowered the investigator with a predictive prescience would diminish community members from the empowered role of agent to that of actor within the control of the investigator. Consequently, an objective of theoretical development in this thesis is to provide school community agents interacting across multiple levels of society with conceptual elements to communicate their understanding of the patterns of interaction that are the process and outcome of their school setting.

1.2 Rationale

The theoretical base of Health Promotion is in the early stages of development. Theories from diverse disciplines have been drawn together for Health Promotion applications (Nutbeam, Harris, & Wise, 2010), however, their strengths seem best credited to their disciplines of origin. There are exceptions but most have been co-opted with little re-theorising by Health Promotion (Potvin et al., 2005; Potvin & Jones, 2011). It is this re-theorising process that should embed the ethic of Health Promotion in resultant initiatives and outcomes. For re-theorising to make a noteworthy contribution to the theoretical base of Health Promotion, it must be done in keeping with the ethic of Health Promotion and as a part of the perpetual scientific process of critique and conceptual development (Rütten et al., 2012).

The physical activity of children represents an important area of Health Promotion activity internationally (WHO, 1995a, 1995b, 1996, 1997, 2004, 2010a, 2010b, 2014). Concern for increases in the prevalence of childhood obesity and anticipated impact on adult health have made the study of physical activity a priority (WHO, 2004, 2010a, 2010b, 2014). The promotion of child physical activity, especially in the school setting, is an area of academic endeavour that has been resistant to efforts to make enduring positive change (Erwin, Fedewa, Beighle, & Ahn, 2012; Metcalf, Henley & Wilkin, 2012). A conceptual approach that includes both an increase in physical activity and a reduction in sedentism is gaining increased attention (Foley, Maddison, Jiang, Olds, & Ridley, 2011; Kipping et al., 2014; Salmon et al., 2005). Such approaches have renewed

interest in programs that encourage greater movement in situations of everyday life (Active Healthy Kids Australia, 2016, Fung et al., 2012). Among these situations are schools programs that promote food gardening (Wells et al., 2014).

This thesis argues that theoretical development is required for Health Promotion professionals to comprehensively investigate this emerging interest in physical activity of daily life programs, in the context of sedentism within school setting situations. The need for such theoretical development is no less pressing in this emerging area than the need that has already been noted in the Health Promotion discipline as a whole (Nutbeam, Harris, & Wise, 2010). Any assertion that this emerging area of investigation is less well served by the adoption of physical activity related theory from other disciplines is outside the scope of this thesis. What can be asserted in the current context is that a need exists to continue an on going academic discourse exploring Health Promotion's changing conceptualisation of school setting activity of this nature. This thesis will contribute to this discourse by explicitly articulating conceptual elements of physical activity from a Health Promotion perspective identified in the course of this study.

Key challenges in developing the theoretical base of Health Promotion relate to the change agenda of the discipline, the diverse social locations attributed with explanatory utility, and the powerful influence of Reductionist positions in Health (McQueen, 2001). Theories of Health Promotion must negotiate a complex, abstract place where the multi-focal social change agenda of Health Promotion neither confounds the Ottawa Charter's edict to 'empower' (WHO, 1986) nor facilitates ethical transgressions of the autonomy of individuals or social groups (Lindbladh, Lyttkens, Hanson & Östergren, 1998). Health Promotion theory must translate Health rationalities located across domains from individual behaviour change to the organisational structure of the largest of social institutions (McQueen, 1996), modelling for healthy outcomes these social structures brought into existence for non-Health purposes (Nutbeam et al., 2010). It must facilitate initiatives that achieve international health outcome targets while being respectful and responsive to the community voice (WHO, 1986) and remaining at all times a thoughtful scientific endeavour (Mantoura & Potvin, 2013).

Health Promotion theory must reflect the pledges of the Ottawa Charter (WHO, 1986), Health Promotion's foundation document, to promote a holistic well-being. It must be an unwavering enactment of the pledges made under the Ottawa Charter to preserve the full scope of resultant Health Promotion practice (Potvin & Jones, 2011). It must strengthen resistance to the modern pressure to reduce holism to a series of strategies and actions individually targeting health outcome gradients (Pate, 1995). Health Promotion theory must offer an alternative to competing partitive interventions responding to perceptions of worsening Health (McQueen, 2000).

An enduring challenge in advancing Health Promotion theory is modelling the facilitation of social change located in the everyday actions of individuals regulated by large social institutions. Health Promotion theory must challenge the traditions of atheoretical life-style interventions (Oakley, 2005) favoured by institutions and mistakenly thought free of unintended harm (Allen-Scott et al., 2014), paternalistically benign. All these challenges exist within a contemporary economic context (Commonwealth Department of Health Australia, 2014) that fortifies the Health Promotion practitioner and discipline with a survivalist pragmatism.

1.2.1 Purpose of Health Promotion Theory

Theory has a dual purpose. It serves as a practical implement to the practitioner (Nutbeam et al., 2010) and academic invigorator to the discipline (Larouche & Potvin, 2013). Each purpose is of equal importance.

Practice Professionalism

The consequences of weak Health Promotion theory at a practitioner level are reflected in substandard design, comprehension and implementation of initiatives (Davies & Macdowall, 2006, p.144). However, the practitioner level purpose of theory should not be over-simplified to a cyclic procedural model that begins with defining a problem and ends with evaluation of the planned solution (Althaus, Bridgman, & Davis, 2013). A fully developed theory, as described by Nutbeam, Harris and Wise (2010, p.1), is one which explains "the major factors that influence the phenomenon of interest ... the relationship between these factors ... (and) the conditions under which these relationships do or do not occur." This is true within a particular approach to Health

Promotion action. The practice of settings approach Health Promotion is also served by theoretical understanding from more social and social policy methodologies, especially those capable of accommodating the multiple levels of influence on school settings and the highly diverse Health Promotion approaches to which an institutional setting may be subject.

Discipline Invigoration

Selective attention to only the practitioner level purpose for theory within particular approaches diminishes the other learned purpose of Health Promotion theory. Theory constrained within approaches offers the discipline of Health Promotion no pause for higher understanding of Health as an outcome in a complex social context, the significance of the settings approach or the discipline's unique position to contribute to the central conceptual debates of Social Science. It is this discipline level purpose of theory that represents the intellectual contribution of Health Promotion as raised above mere health education materials production, environmental risk analysis and the chronicling of cautionary tales from successive program interventions and evaluations.

Strong and advancing Health Promotion theory promotes the vigour and efficacy of Health Promotion as an ethic, profession and discipline (McQueen, 2000).. A paucity of theoretical substance lessens confidence that a sufficiently wide ranging and conceptually sophisticated set of influencing factors (Allen-Scott, Hatfield, & McIntyre, 2014) have been considered beyond initial scoping thoughts (Bauman, Philayrath, Schoeppe, & Owen, 2006). The absence of Health Promotion theory capable of representing a dynamic social context, forces the profession to assume factors, identified from previous program experience, as representing stable or even universal relationships (Gaglio, Shoup, & Glasgow, 2013). Visualising the complexity of even one small area of health causation, this assumption is almost certainly untrue (Public Health England, 2015). Worse, atheoretical Health Promotion is limited in its ability to hypothesise social structures in the absence of intentional Health Promotion activity, limiting the discipline in its capacity to understand chaotic situations and therefore the full scope of its own effect.

Atheoretical Void

The atheoretical void does not foster the ethic of Health Promotion. In the atheoretical void, program expertise flourishes without breadth or depth of thought on Health beyond a limited set of program objectives and measures. Without a secure, mature theoretical base, Health has fractured meaning and a difficult relationship to social structures and determinants (Van Beurden, Kia, Zask, Dietrich, & Rose, 2013). Even the nirvana of program translatability has little substantiation and grounded theory for settings can languish in non-innovative situational isolation (Timmermans & Tavory, 2012). Assumptions of stability in the conditions underpinning modelled or grounded relationships can become obscured or forgotten and subsequent efforts to engage apparently similar settings in health change are undermined by the ubiquity of these assumptions (Bowen et al., 2010). Successful translation becomes an exercise in finding the right community or bending the wrong community to the will of the program (Michie et al., 2011; Pearson et al., 2015).

While a small theoretical base is problematic for Health Promotion as a practice of professionals, a simplistically co-opted theoretical base is just as limiting for Health Promotion as an academic discipline (Larouche & Potvin, 2013). Without active engagement in theoretical advancement within this discipline, Health Promotion will remain a reactive practice, reliant on influences driving theoretical development in other disciplines (McQueen, 2000). To claim a legitimate place of influence the discipline of Health Promotion needs the capacity to promote its own unique perspective, its own intellectual and change agendas (Weisz & Vignola-Gagné, 2015), to unify its disparate approaches into an effective arsenal. Without theoretical development driven from within the discipline, Health Promotion risks becoming stagnant and cursory, missing the opportunity to be a steering force of social structuring and healthy personal autonomy.

The sense of professional promise captured in 1986 in the Ottawa Charter needs expression in theory development in order to be realised in an enduring intellectual form (Shareck, Frohlich, & Poland, 2013). That promise placed Health Promotion interests within the realms of peace, housing, education, food, income, environment, resources, social justice and equity (WHO, 1986). Without an advancing and developing

theoretical base, Health Promotion risks becoming a dispersed presence, of questionable effectiveness in influencing the agendas of other realms and with little capacity to record its own critical and strategic progress toward fulfilling Ottawa's visionary agenda (Hancock, 2011).

For either of these two reasons – practice professionalism or discipline invigoration – there is a need to engage in Health Promotion theory.

1.2.2 Schools as Health Promotion Settings

The preventive agenda is increasingly directed at child populations and schools represent, to many, nothing more than a convenient location providing good access (Friend, Flattum, Simpson, Nederhoff, & Neumark-Sztainer, 2014). In 1995 the World Health Organization (WHO) launched their Global School Health Initiative (WHO, 1995a). From this initiative arose recognition of schools as more than just venues for school health programmes. Schools came to be recognised as possible Health Promotion entities, instruments in their own right (WHO, 1996). The concept of the Health Promoting School emerged at this time (WHO, 1995b)

The Health Promoting School is a highly developed settings approach (Denman, 2002) but one which remains difficult to delineate because of its notional nature. HPS assume responsibility for promoting health and well-being in and through their members, including school personnel, families, students, and members of the broader community (WHO, 1996, p.ii). HPS are a place and a process for creating healthy living (WHO, 1995a; WHO, 1995b) and a positive and socialising force people look to with hope in their everyday lives (Aggleton, Dennison, & Warwick, 2010). In the words of Kickbusch and Jones (1998, p.1), HPS "monitor progress in achieving their health objectives and use the findings to improve their efforts". HPS value physical, mental and social well-being (Kickbusch & Jones, 1998). Many schools lay claim to these attributes, yet few observers would label them HPS.

Health Promotion in a HPS is action-based and evidence-informed. There is a commitment in HPS to preventing health risks and problems in their community (Aggleton et al., 2010). This they achieve by using information to set priorities, employing a social process to devise plans and actuate their community members as a

resource to enact evidence-based responses (Jensen, 2000; Rasmussen & Rivett, 2000). Although the process of implementation is often steered by professional involvement (Long-Shan et al., 2000; Senior, 2012), HPS school communities remain lay communities with lay rationalities. The communities, however, are participatory.

Health Promotion in the HPS setting is intentional and comprehensive. Transition to a HPS form is an iterative process (Senior, 2012) and a desirable long-term objective (WHO, 2014). Health Promotion theory is needed to help facilitate that transition.

1.2.3 Physical Activity from a Food Gardening Program

Food gardens have been a persistent feature of schools across the ages (Miller, 1905; Sullivan, 1915). Their many uses and professed benefits change but persist (Blair, 2009). Contemporary programs are most often established and studied for their impact on healthy food choice and appreciation (Morgan et al., 2010). Recently, evidence from a randomised trial of a school food garden intervention has been presented to support the possibility of increased physical activity from garden based programs (Wells et al., 2014). Some limited research has shown taking a HPS approach in a garden program to have had positive effects promoting children's physical activity (Oosman, Chad, & Smylie, 2011).

The opportunity to study the physical activity of school food gardens as a means to develop Health Promotion theory in the school setting arose serendipitously. While the choice of initiative and appropriate theoretical proposition was important, any number of initiatives could have furnished the experience of Health Promotion in the school setting required to explore theoretical issues.

There are four key reasons this school food garden opportunity was pursued for this purpose.

Firstly, the opportunity needed to present occasions to observe 'new' (meaning 'additionally recognised') health-related outcomes without needing to influence delivery of an initiative or induce behaviour change. This would enable the study of a mature initiative beyond program start-up issues. Secondly, the 'new' health-related outcome had to be universally recognised for its relationship to child health. This was necessary so there was no doubt that the study was one of theoretical advances of Health

Promotion rather than some other social or educational agenda. Thirdly, a mature literature base had to exist relating both individual and setting elements to the 'new' health outcome to be measured. This was necessary to prove it was possible that the 'new' outcome had been successfully promoted in a setting previously, suggesting it was realistic to explore the potential for increase this time. Finally, the program initiative needed to have the possibility of wide geographical implementation, preferably international, to ensure theorising was being undertaken in a sufficiently significant Health Promotion initiative.

As it transpired, two reviews of a national kitchen garden program in recent years had identified health outcomes only indirectly related to the food experience objectives that had driven the development of that initiative (Block et al., 2012; Block et al., 2009; Yeatman et al., 2012). From their qualitative reports, Yeatman et al. (2012) raised the possibility that other health related outcomes might be found in garden programs, specifically stakeholders had mentioned increased physical activity, and that this might be a fruitful area for an investigative re-visitation. Gardening is a popular leisure time pursuit commonly reported in population surveys of physical activity internationally (Craig et al., 2003; WHO, 2010a) associated with health and physical activity across the life course (Zick, Smith, Kowaleski-Jones, Uno, & Merrill, 2013) and promoted to parents as a valuable physical activity for their children by national health promoting organisations (State Department of Health & Human Services Victoria, 2016; National Heart Foundation of Australia, 2016).

Suitability Analysis of School Food Gardening

The school food gardening opportunity supported all four key considerations outlined above for pursuing an initiative in which to locate this present study. Firstly, physical activity would appear to be almost inseparable from the conduct of garden sessions and represents a 'new' health-related outcome in that particular program context with no change required to the delivery of the program. Physical activity in school food gardens offered the opportunity to reflect on an outcome measure not influential in the initial design but one which schools value and have taken responsibility for in other initiatives.

Secondly, physical activity enjoys almost universal recognition for its relationship to health (World Health Organisation, 2010b). A wealth of information exists linking

childhood physical activity to growth and development, physical fitness, and psychosocial health of children (Australian Institute of Health and Welfare, 2012).

Thirdly, the literature base describing children's physical activity at school is still maturing (Parrish, Yeatman, Iverson, & Russell, 2012) and relatively little is known about physical activity from the school food garden. School settings are important to children's active lives (Mota et al., 2005; Nielsen & Andersen, 2010; Ridgers, Stratton, & Fairclough, 2006; Stratton, Ridgers, Fairclough, & Richardson, 2007), however we know little about the contribution of school gardens to the physical activity of children as very few have actively sought to promote physical activity outcomes (Hermann et al., 2006; Jacquart et al., 2010; Phelps, Hermann, Parker, & Denney, 2010) despite the regular contribution gardening is known to make to physical activity in later adult years.

Finally, school food gardening has sufficient scope. Garden programs have long been championed in schools (Heinze, 1978; Kailasapathy, 1988; McGinnis, 1989; Miller, 1905; Sullivan, 1915; White, 1967) and represent stable school setting initiatives in diverse communities (Davis, Ventura, Cook, Gyllenhammer, & Gatto, 2011; Hazzard, Moreno, Beall, & Zidenberg-Cherr, 2012; Somerset & Bossard, 2009). Health Promotion initiatives developing food gardening are evident across countries (Dyment, Bell, & Lucas, 2009; Hazzard, Moreno, Beall, & Zidenberg-Cherr, 2011; Park, Lee, Lee, Son, & Shoemaker, 2013; Waliczek, Bradley, & Zajicek, 2001; Wills, Chinemana, & Rudolph, 2010). Children's physical activity is undoubtedly an international health concern (WHO, 2014).

Investigating an existing schools setting Health Promotion initiative, one past its start-up stage issues, for its potential to impact an outcome significant to child health though not one intentionally targeted by the initiative designers, is well placed to provide insights relevant to the development of Health Promotion theory while creating minimal interruption in the lives of the children or their schools. Investigating the physical activity of school food gardening is such an initiative.

1.2.4 Summary of Rationale

Health Promotion theory is an essential aspect of maintaining professional practice, developing a strong academic discipline and facilitating effective change in Health

Promotion settings. Further theoretical development is needed to address challenging aspects of schools setting Health Promotion and facilitate the implementation of HPS. Resolution pathways for these challenges may be identifiable with a theoretical approach using structuration and institutional development. A recent evaluation found subjective evidence of the potential of a national school food garden program to accommodate more diversified health outcomes (Yeatman et al., 2012), specifically physical activity. Measuring and understanding the study of physical activity in school food gardens and identifying garden physical activity health outcomes present an opportunity to develop Health Promotion theory in the school setting.

1.3 Theoretical Framework

This thesis remodels and further develops a theoretical proposition published by Rütten and Gelius (2011). The proposition is strongly influenced by the Institutional Analysis and Development Framework of Elinor Ostrom (2005), Peter Giddens' Theory of Structuration (1984) and William Sewell's axioms of change from his Theory of Structure (1992), with selected elements of the Ottawa Charter (WHO, 1986).

The theoretical aim of Rütten and Gelius (2011) was to discuss the interplay between structure and agency in Health Promotion. Their particular interest is in optimising policy environments and their casework was conducted in a community setting. They argued it is a limitation that Health Promotion practice draws fundamentally on structure and agency but Health Promotion theory less so. Deconstructing and remodelling Rütten and Gelius's theoretical proposition enables the representation of Health Promotion in institutional settings as a multi-level process of structuration, leveraging the strategies of the Ottawa Charter (WHO, 1986), one given change capabilities through the multiplicity and polysemy of Sewell's axioms (Sewell, 1992).

Unchanged, the theoretical model of Rütten and Gelius is not sufficient for the purposes of this thesis, where theoretical development suited for the school setting is a key aim. However the multi-level possibilities of the component theories Rütten and Gelius (2011) assembled make further development and a remodelling a project worthy of pursuit for the purposes of school Health Promotion. A number of features of the schools setting made the potential value of theorising with a Structuration based model immediately evident:

1. Schools are a socializing force characterised by significant social action and early experience of greater individual agency in children's lives (Durkheim, 1977).
2. In these institutionalised structures, recognition and celebration of a school's individual 'ethos' is attributed to unique actions of the school community (Aggleton et al., 2010).
3. Initiatives commonly target both structural (ecological) and agentic (behavioural) change in schools (Demetriou & Höner, 2012; Sallis & Glanz, 2006; van Sluijs, McMinn, & Griffin, 2007).
4. Schools accumulate complex drivers and motivations, serving multiple social purposes and are exposed to diverse stakeholder interests across many levels of management and control (WHO, 2004).
5. Sustainability of school setting behaviour change initiatives is poor and ecological initiatives only survive slightly better (Friend et al., 2014).

Together, these five features point to key characteristics addressed by Rütten and Gelius's theoretical proposition. The component theories constitute a proposition that is based in the interactions of daily life, addresses structural and agentic aspects, permits modelling of the influence of decisions made across multiple levels, is based in a Health Promotion agenda, and has the capacity to describe a complex institutional setting. It offers new insight into sustainability of school setting initiatives and suggests exciting prospects for the emergence of HPS. Consequently, the theoretical framework of this current study begins with the work of Rütten and Gelius, with the express purpose of further challenging this promising theoretical proposition.

1.4 Choice of Methodology

This is a descriptive study that uses a Mixed Methods methodology at purposively selected schools in a Case Study approach. Quantitative, qualitative, objective and subjective evidence was collected and integrated with a concurrent ethnographic analysis of the schools setting. The multiple methods approach was chosen to explore different aspects and interpretations of the key concepts in the first of the research questions: 'potential', 'increase' and 'physical activity'. It was designed to provide sufficient experience of the Health Promotion initiative in the school setting to inform conceptual and theoretical inquiry to properly address the second question.

In studying a small number of schools in depth, this case study sought the perspectives of school community members on the potential of the school food garden as a place for promoting health through physical activity. It reports observations and experiences in the school setting and findings of objective physical activity measures. These were analysed systematically and reflexively with a view to critiquing concepts and measurement methods of Health Promotion in the school setting in order to propose advances in Health Promotion theory.

This study was designed as a series of increasingly contextual perspectives, reflected in the choice of methods. First, accelerometery was used and intensity variables derived from a number of different cut-point sets, to probe objective quantitative measurement. Different ways of representing the group data were examined to discuss options for the best method to represent food garden physical activity from a Health Promotion perspective. Second, time-lapse photography was used to describe garden use and physical activity out of food garden session times to further inform opportunities for increased garden physical activity. Third, video imaging was analysed qualitatively to describe the nature of physical activities involved in school food gardening. These initial three methods focussed on the garden program itself.

Fourth, group interviews prompted by photo-elicitation were conducted with the children and semi-structured interviews with the teaching and garden staff respectively. The subject of discussion was the relationship of physical activity, Health and the school food garden. Themes of these interviews introduced a subjective participant perspective. These participant-identified outcome types were modelled for the theoretical question. Finally, time in the school setting was the subject of an ethnographic process where field notes systematically recorded the experience of the researcher in the school setting for use in the conceptual and theoretical discussions and developments of the study. The ethnographic method captured interactions with parents at the schools. These final qualitative methods were directed at placing the garden program within the broader school setting.

School food garden physical activity has a purpose and a legacy. Measuring its volume and intensity is important but insufficient for Health Promotion purposes. These mixed methods report on the local interpretation and use of school food gardens and how the

outcomes of garden physical activity relate to health in the eyes of community participants and Health Promotion in the school setting. The experience of conducting these methods in schools informed the development and remodelling of Health Promotion theory for the school setting.

1.5 Research Questions

The aim of this mixed methods case study is to understand the physical activity of school food gardens from a Health Promotion perspective in order to situate further development of a theoretical proposition for use in the school setting. The objectives are to:

- measure the physical activity of children undertaking a series of garden classes
- determine the relative contribution school food garden classes to the physical activity of the school day
- identify factors that demonstrate potentials and opportunities to increase physical activity
- examine from a Health Promotion perspective the concept of physical activity in the school setting
- identify relationships drawn by participants between school food garden physical activity and health, where they exist
- establish whether those relationships can be modelled in keeping with a Health Promotion perspective and structuration approach
- identify applications of the modelled relationships that may serve to advance Health Promotion theory in the school setting
- further develop an existing theoretical proposition to create a community accessible model of institutional development for use in Health Promotion in the school setting.

To achieve this aim and these objectives, two research questions are posed for this study:

1. Do food gardens in schools have the potential to increase physical activity?

2. What advances to school setting Health Promotion theory can be made using structuration and institutional development approaches?

The first research question explores physical activity in the food garden within the intellectual framework of Health Promotion. Two premises are tested: whether school food gardening is already a source of physical activity for health and whether there are realisable opportunities for food gardening to provide still more physical activity.

Exploration of school food gardening as a current source of physical activity starts with an objective perspective. The measurement of physical activity by accelerometer is critiqued for its ability to indicate increases in garden physical activity. Measures of physical activity in the garden are compared to other school situations in which children are active. Next, time-lapse photography and video images are used to provide context for realisable opportunities to increase garden physical activity. The first research question provides the opportunity to discuss the concept of physical activity from a Health Promotion perspective and to explore the relationship between method, methodology and theory.

The second research question examines what structuration and institutional development can bring to Health Promotion theory in the schools setting. Theorising starts with the description of participant-identified health outcomes (PIOTs) from garden physical activity, modelled by drawing on Structuration Theory. The PIOT model is integrated into an existing theoretical proposition (Rütten & Gelius, 2011) based on the Institutional Analysis and Development framework incorporating Structuration Theory, Theory of Structure and elements of the Ottawa Charter. A new model representing the extended proposition is described and its explanatory power is tested by challenges from two change opportunities identified in this case study. Transition of an existing food garden program initiative into a HPS setting is hypothesised using the new model; the community accessibility of the model is demonstrated by this application that is presented as if for a lay audience.

1.6 Scope and Limitations

This case study has specific descriptive and theoretical purposes. The measurement of physical activity using mixed methods is to inform those purposes. Conceptual and theoretical advances have been the result of analysis directly related to the physical activity of schools conducting food garden programs. Confirmation of the relevance of these analyses should be undertaken where the concepts and theories are translated to different contexts.

The purpose of measuring physical activity in the case study schools using accelerometry was threefold; to:

1. positively identify physical activity in school food gardens using a conventional measure and understand the choices in accelerometry protocols on the reporting of garden physical activity intensity.
2. observe occasions of inter-test variability between sessions and between locations, raising issues of scope for future investigation.
3. identify realisable opportunities for increased physical activity from the program as measured by accelerometry.

The accelerometer data produced an accurate description of these garden sessions but are not generalizable to the broader population. The results are a source of indicative values from this method of measurement only. Localised interpretation of information is a necessary recommendation from the accelerometry method of this study.

The purpose of time-lapse photography was to record the use of the gardens outside formal session times. Initial plans to quantify this activity using an ecological observation method had to be abandoned in light of the very low use of the garden sites during non-lesson periods. Observations were reported qualitatively with a conceptual analysis of school food garden physical activity. Further observation of similar activity of daily life should broaden and deepen the results of this analysis.

The video imaging of the garden sessions has been analysed qualitatively for the purposes of this study. Plans to quantify actions observed in the images in conjunction with time synched accelerometer data were retired. A method for quantified observation of children's garden physical activity (Myers & Wells, 2015) was published in the very

late stages of preparing this thesis. In light of this development, a participant-engaged variant of quantitative observation that appropriated an existing schoolyard observation technique was removed for separate publication, to enable further conceptual and theoretical discussion not directly relevant to the principle line of argument of this thesis.

The origins of the case study garden programs were related but different, presenting a limitation and benefit to the scope of this study. Two of the programs were established from the same national funding source and the third, already established from a corporate grant, was consulted during the design of that national funding initiative. Consequently, the garden programs at Schools 1 and 2 were established with similar philosophical and pedagogic influences, whereas the garden program at School Three reflects a permaculture design philosophy. Over 300 school food gardens were established from the national funding source that gave rise to the case study gardens at Schools 1 and 2 (Alexander, 2007); hundreds of others have been influenced by the foundation that was funded to facilitate the national program (Stephanie Alexander Kitchen Garden Foundation, 2016). The foundation continues to promote a food garden program, advocating these same philosophical and pedagogic influences. The current sources of financial support for each case study school now vary between each site and differ from their original sources. These initial and on-going funding arrangements may have influenced the physical activity of the respective programs.

A selection of academic literature for school food garden programs has been reviewed, limited to accelerometry studies identifying the physical activity of school food gardening. This review focuses the case study on methods of measurement for Health Promotion studies and decisions that influence our understanding of intensity of garden physical activity. Accelerometry is becoming an increasingly common method for population surveillance trials (Centers for Disease Control, 2016). The garden accelerometry literature is critiqued with a view to further clarifying a Health Promotion perspective. These decisions and purposive focus on Health Promotion methods were taken in light of the relationship between the development of method, theory and an academic discipline (McQueen et al., 2007).

The Health Promoting School concept is described with reference to early publications of the WHO from their Global School Health Initiative. Government, semi government agencies and academics have continued subsequent and on-going development of the HPS concept and key amongst these are included in the discussion (Denman, 2002; Langford et al., 2014; Langford et al., 2011; Samdal & Rowling, 2012; Senior, 2012). The purpose of drawing heavily from a limited number of early WHO sources in the opening chapters of this thesis is to preserve the integrity of the concept of HPS until their notional, continuous nature can be argued later in the thesis.

Schools with food gardens approached to participate in this study were all New South Wales Government schools[i]. This decision was time-resource influenced, avoiding the need to prepare several separate ethics applications for the Non-Government school sectors. The use of Australian government schools coincided with a period where there was no recent, active or on-going promotion of the HPS concept during this case study.

1.7 Description of the Chapters

This thesis is presented in a volume of eight chapters. Given the nature of the thesis and its highly diverse methods, there is not a separate literature review chapter. Reviews of the literature are situated in the opening sections of the various data chapters, commencing in chapter 3.

Chapter 1 has introduced the rationale for this work, stated two research questions, identified the theoretical framework, outlined the choice of methodology and described the scope and limitations of the work.

Chapter 2 describes the case study, the schools and provides a perspective of the schools as settings.

Chapter 3 is the first of the data chapters and focuses on the objective measurement of current levels of physical activity in the school food garden using accelerometers. The chapter opens with a review of the very limited body of literature reporting the physical activity of school food garden programs from accelerometry studies. The later parts of the chapter report the empirical investigation of garden session physical activity.

The potential for increased physical activity from a school food garden is related to current levels of physical activity and realisable opportunities for health promoting change to those levels in the school setting. Variation in physical activity measured by accelerometry across a series of garden sessions is reported. Garden session physical activity is then compared and contrasted to physical activity measured in other school-day segments. Three opportunities to realise potential increases in garden physical activity are discussed. A short critique of methodological approaches for measuring physical activity in the school food garden is presented as the concluding discussion.

Chapter 4 is a second data chapter introducing visual methods to contextualise potential for increased physical activity in school food gardens and continues to explore the issue of realisable opportunities for change. A time-lapse camera method reveals the use of food gardens at times of the week outside garden sessions. The physical activity undertaken during those food garden sessions and the social context are described. Details of the descriptions are provided for the information of the reader in an appendix to accompany Chapter 4. The discussion analyses seven conceptual aspects identified as key features in a Health Promotion perspective of physical activity. The first research question is answered in the affirmative.

The aim of the remaining chapters is to address the second research question and investigate Health Promotion theory through structuration and institutional development by developing and remodelling Rütten and Gelius's existing theoretical proposition.

Chapter 5 identifies three participant-identified outcome types (PIOTs) of garden physical activity from analysis of the qualitative group and individual interviews with children and adult participants. This provides empirical evidence that school settings are structured by Health Promotion initiatives. Chapter 5 uses the process concept of Structuration Theory to model the relationships between these three health outcome types. The model of the PIOTs is configured as three linked Mobius bands thereby representing the three outcome types as a perpetual process of school setting structuring. This model is named the Structuration Links Model.

Chapter 6 remodels Rütten and Gelius's existing theoretical proposition with a re-emphasis on the form of the Institutional Analysis and Development Framework

(Ostrom, 2005) and integrates the PIOTs model with it as a structuration micro-structure. The new theoretical proposition is imagined and described.

Chapter 7 concludes the thesis with a discussion of health promotion programs and the process of institutional development, hypothesising a developmental continuum between the concepts of Health Promotion initiatives in schools and the HPS ideal. The case is presented for using a structuration model such as that developed in Chapter 6 to engage school communities in the process of facilitating transition from an established school setting Health Promotion initiative into a more comprehensive (one avoids using the word structured) Health Promoting Schools setting. The chapter concludes stating the findings of the case study analyses, answering each research question and making recommendations for future directions in schools setting Health Promotion theory.

1.8 Chapter Summary and Conclusion

A rationale for the study was presented explaining that the objective of the study is to advance health promotion theory in the schools setting using a case study of a school food garden initiative. This introductory chapter has identified the unique contribution to the understanding of Health Promotion theory in the schools setting expected from the study of physical activity in school food gardens. This chapter outlined the aims of this research as being to provide a descriptive overview of the physical activity of school food gardens, to identify potential for the food garden as a place for promoting increased physical activity and, based on these findings and the observers experience of the school setting, to explore advances in Health Promotion theory.

Two research questions were posed:

Do food gardens in schools have the potential to increase physical activity?

What advances to school setting Health Promotion theory can be made using structuration and institutional development approaches?

The rationale to engage with an integration of social theories proposed by Rütten and Gelius (2011) is presented. The approach and methods for the case study are described. The scope of the thesis is limited to its descriptive intention. The chapter structure of the thesis was described.

2 CASE STUDY DESCRIPTION

This chapter describes the schools and garden sites of this mixed methods case study and the research methods through which they have been viewed. Justification for the choice of mixed methods case study is provided before specific methods for the case study are explained. Rationales for the methods and the procedures are detailed for accelerometery, video imaging, photography and collection of interview data. A perspective of the school setting is described, developed from the ethnographic observations of the study. Observations of the case study schools as settings are related in terms of organisational context, local variations, the social relationships within schools and unique practical and ethical considerations of working in an environment with children.

2.1 Study Schools

2.1.1 Recruiting Procedure

The case study was granted approval by the University of Wollongong and Illawarra Shoalhaven Local Health District Health and Medical Human Research Ethics Committee. The process included a second approval from the State Evaluation and Research Application Process (SERAP) of the New South Wales government to enable approaches to schools in the State school system to participate. Limits existed on the number of permissible attempts to follow-up communications with schools and access to images created by video and photography methods. Non-disclosure agreements and current Working with Children registration were required of study personnel. Data were coded to protect the identity of participants and collection procedures established in each location to ensure the efficacy of these measures.

Three primary schools in New South Wales (NSW), Australia, were selected purposively for this study. Schools were approached based on their proximity, integration of garden and curriculum, and a minimum 12 months since the establishment of their garden program. Initially only NSW Primary schools from the 208 listed on the Stephanie Alexander Kitchen Garden (SAKG) Foundation website (at 11 December 2013) were considered; 31 were approached.

The Stephanie Alexander Kitchen Garden National Program (SAKGNP) had received positive evaluation reports (Block et al., 2009; Yeatman et al., 2012) suggesting an established, successful Health Promotion initiative. A perception of program implementation constancy arises from the branded, centrally developed program materials and training, use of a Demonstration Schools model, and the standardising nature of Commonwealth funding applications. During the data collection stage that constancy proved illusionary. Study schools no longer received funds from SAKGNP. Although they continued to use SAKGNP material resources and infrastructure funded via the program, the schools had transitioned to different funding sources to sustain their food gardens.

During the Ethics review process, SERAP officers suggested including in the case study non-SAKG school food gardens. School Three was approached to diversify program origins and so strengthen the theoretical purpose of the study. Their garden program had been established for approximately eight years, has a national reputation and was part of a social initiative funded initially by an industrial corporation. School Three had applied for, but not received, SAKGNP funding, however, their program material had been made available to, and may have had an influence on, the SAKG program developers. The garden at School Three fulfilled the locality, integration and establishment criteria.

Principals were contacted in May 2013 with a brief project description as they have a delegated authority to decide whether to engage in SERAP approved projects. Follow-up telephone calls found eight interested Principals who were sent a full Research Project Information Package. The next contact included a discussion of the school's specific needs to enable involvement.

Several of these eight schools delivered their program to Stage 2 students (Grades 3 and 4, nine-10 year olds) but not to Stage 3 students (Grades 5 and 6, 11-12 year olds). The intended population was the older students. Lowering the age of the intended population would compromise physical activity recall and subjective methods, given the children's developmental age. Of the eight schools, three withdrew their interest citing an overly full school calendar, garden staff being too busy and in anticipation of disruption from unexpected notice of staff changes. Two schools became un-contactable after the follow-up attempts reached the limit permitted by Ethics approval.

Verbal agreement and written school-level consent were given by three Principals of Government Kindergarten-Grade 6 primary schools, located in diverse communities with unique profiles. Data collection commenced in School One in May, School Two in August, and School Three in June 2013. Our recruiting experience demonstrated early peculiarities engaging school communities as an outside body in the absence of an established relationship; other challenges of school recruitment will be addressed after introducing the schools.

2.1.2 School One

All 26 members of the combined upper primary class (Grades 4-6) were approached via study materials sent home from class; 24 (nine boys, 15 girls) gave informed consent and assent.

School One is a small (fewer than 120 students) provincial school reporting 94% attendance in 2013 and an Index of Community Socio-Educational Advantage less than 60 points above the national average of 1000 (Australian Curriculum Assessment and Reporting Authority, 2015). The school is fully subscribed with 'out of area' enrolment bids that cannot be accommodated and sibling enrolments maximising classes. The Principal describes the school community as middle class families with little ethnic diversity. Economic diversity arises from an industrial area in the mainly rural catchment and professional commuter families.

The Principal attributes increased enrolment interest to the garden program, believing it makes School One more competitive with the local private school. The Principal believes that the generous engagement and enthusiastic support of the parents and school community is attributable to the perceived value of the garden program. The garden is a curriculum endeavour and distinguished from other programs conducted at the school to provide physical activity, spoken of by the Principal as mutually exclusive concepts.

The food garden program has been integrated with the curriculum for four years and all students had at least three years' experience working their well-resourced garden. A garden session, lasting 45-60 minutes, is conducted each week on Friday after morning break. A kitchen session, lasting 60-90 minutes, is conducted each week on Tuesday

prior to, often including part of, the lunch break. Specialists are employed to deliver both sessions and are assisted by teachers and volunteers. Garden data collection days occurred during garden sessions from the regular lesson schedule. Local weather on these days was dry, warm, and sunny with temperatures within average seasonal ranges. The conditions are described in Table 2.1.

Table 2.1 Local weather for the garden session series at School One

Weather	Session One	Session Two	Session Three
Daily			
Min Temperature C ^{0}	3.2	10.2	14.1
Max Temperature C ^{0}	13.7	23.4	20
Rainfall mm	0	0.4	3.6
Solar Exposure MJ m^{-2}	16.4	30.2	11.7
At 9am			
Relative Humidity %	77	87	85
Wind Speed km/h	4	Calm	26
Wind Direction	SSE		NE

Source: Bureau of Meteorology, Australia

The garden was started in 2008, receiving establishment funding from the SAKGNP in 2010 and on-going funding from the efforts of the school community and 'generous' donations of a local enterprise. These sources funded the construction of a commercial kitchen used by the students. Venue hire, event hosting and the barter of garden produce with a local merchant for dry goods make the garden program self-funding. Use of the kitchen raises funds during regular markets held at the school, however, the organising committee are respectful of their established relationships with food stall providers and limit kitchen activity.

The organic garden is an area 70m by 30m at the back of the school buildings with bed areas, poultry run, covered learning area, tool shed, fruit trees and a compost station. A stand of citrus is planted at the school entrance. The school has been unsuccessful in involving the students in a composting program, attributed to their lack of strength, coordination and skill required to turn the piles. The garden was an initiative of the school community having its genesis in a series of school meetings and group decisions

that began with the construction of a dedicated visual arts space and ended with the establishment of a kitchen and food garden.

A welcoming response was received to the invitation to participate in the research after time-tabling concerns were addressed including those arising from a foreshortened Term 2 and an approaching winter. The Principal liked that the study aimed to test assumptions, not impose a physical activity agenda. Scoping discussions with the class teachers covered duty of care to the children and school community and the perceived complexity of the research program. Working through the methods individually helped identify their true impost and a clearly articulated set of conditions was negotiated.

The Principal was cautious about the adiposity measures, citing the risk they could stigmatize individuals; this prompted specific risk management processes. Also a jocular concern was expressed that time-lapse photography of a garden empty all week could undermine the perception of the gardens centrality to the school. Access to those images was already limited to the Principal and Researcher by the ethics committee. By contrast, high value was placed on the expected enjoyment the children would experience photographing their garden and speaking of its health benefits to the school community.

2.1.3 School Two

At School Two all 77 members of the three composite Stage 3 classes were approached via study materials sent home from class; 61 (30 boys, 31 girls) gave informed consent and assent.

School Two is a provincial school with a reported attendance of 95% in the year 2013. The Principal described the school community as being in a state of change, with new families generating consistent enrolment growth, from an enrolment of less than 220 students in 2008 to greater than 280 students in 2013. The Index of Community Socio-Educational Advantage for 2013 was lower than 880 points (Australian Curriculum Assessment and Reporting Authority, 2015). Approximately one third of children enrolled in the school identify as Indigenous Australians. English is listed as the first language for all the students.

School Two is a member of a cross-agency initiative involving the school community, human service agencies and non-government organisations, aimed at prevention and early intervention for families. Home-and-school partnership is a core theme. Children and parents participate in a school transition program to engage families with their children's school learning. Consequently, school families were already familiar with the food garden. The cross agency facilitator has been a champion of the food garden program and uses gardening in school beautification initiatives in the school and local environs as an engagement strategy.

The Principal of School Two also attributes increased interest and diversity in enrolment to the food garden program, stating proudly that School Two is an increasingly attractive alternative to a government school approximately 2.5km distant and a Catholic school within 1.5kms. The garden is a source of community recognition and awards, a stimulus for important visitors and investment of human and economic capital from the community. School Two has received local government awards for their worm farming and shared their garden expertise in ‘Kids teaching Kids’ programs with other schools nearby. The teachers arrange an award winning display of garden produce at the annual Agricultural Show. A 2010 school survey found 98% of Stage 2 and Stage 3 students enjoyed the food garden program more than any other school activity. Students, parents and teaching staff commented on the improved aesthetic of the school as a result of developing the food garden.

The food garden is well integrated into the academic curriculum and is expanding to include all grades. The school report nominates healthy lifestyle, cultural understanding, sustainability and environmental education as the foci of the food garden. Teaching in the garden started in 2008 when the parent group provided funds for the development of the compost area. School Two was among early recipients of SAKGNP funds in NSW in 2009 with which they built a kitchen. The scope and sequence for Stage 2 and Stage 3 was reviewed in 2009 to integrate the curriculum systematically with the program. The garden has been in a state of constant development. In 2012 a dining room was added from funds provided by the parent group and a local private enterprise. In 2013 program planning remains the responsibility of the school executive and the specialist Learning and Development teacher, who is also employed as the Garden Specialist.

The garden program received funding support from 2009-2012 through the Priority Schools Program, a literacy and numeracy initiative that aims to enhance participation in learning. In 2013 Transitional Equity Funding was used to continue the food gardening program. Ad hoc funding continues to be received from community donations and programs. These applications require a significant on-going investment of human resources, notably from the Learning and Development teacher.

School Two is situated on a very large block of flat open land. The original compost area was expanded with six 2.5m square raised garden beds circled by a 1.8m boundary fence. Subsequent additions include a citrus and stone fruit orchard, the kitchen and dining room building, a large poultry run, a covered learning area, tool shed, water tanks and 12 in-ground garden beds. These features are located within an area 100m by 35m located along the main street frontage and entrance to the school administration building.

School Two staff accepted all the research methods, with adjustments to address local implementation issues. The recall diary was not a successful data source at this school as a number of students in each class needed substantial support reading, making the information in the diaries unreliable. Plans to have the students wear accelerometers during waking hours for seven consecutive days were vetoed by the classroom teachers who expressed concern that many of the accelerometers would be forgotten or not returned and this represented an unnecessary disruption to the good relationships enjoyed between the school and families. In any case, the response to participate exceeded expectation at this site and there were insufficient accelerometers available for the allocation of spare units that would have been required for the study to proceed unmodified. Instead, accelerometers were worn during school hours for five consecutive days by each of three class groups.

Garden data were collected on three occasions during garden sessions from the regular lesson schedule on 1st, 15th and 29th August 2013. Local weather on data collection days was dry and mild with temperatures within average seasonal ranges. The conditions are described in Table 2.2.

Table 2.2 Local weather for the garden session series at School Two

Weather	Session One	Session Two	Session Three
Daily			
Min Temperature C ^{0}	3.4	3.1	9.4
Max Temperature C ^{0}	16.4	13.8	23.3
Rainfall mm	0	1.8	0
Solar Exposure MJ m^{-2}	13.59	18.05	12.47
At 9am			
Relative Humidity %	71	76	60
Wind Speed km/h	1.02	2.87	6.3
Wind Direction	NE	N	N

Source: Bureau of Meteorology, Australia

2.1.4 School Three

School Three was the last school approached to participate in the study. Ultimately, only school staff became study participants. Despite the school community's enthusiasm for sharing knowledge from their garden, during discussions with the Principal it became evident that the practicalities of informed consent in this community were insurmountable given the study resources. There was an opportunity to tour the garden and observe recordings of garden sessions available on the public record. Teaching and garden staff gave semi-structured interviews. These were conducted in November and December 2013. Follow up interviews were conducted in February 2015.

School Three is a small (fewer than 140 students) metropolitan school reporting attendance of 94% for 2013. The Index of Community Socio-Educational Advantage was lower than 910 points, with 64% of children in the lowest quartile and only 10% in the highest half (Australian Curriculum Assessment and Reporting Authority, 2015). Over three quarters of students list a language background other than English. The Principal describes the school community as characterised by a tradition of transition related to emerging ethnic groups as new families join the school. The school

community receives families making their entry into Australian society and incorporates extensive community language and new arrivals programs.

The food garden is a fundamental aspect of school identity. The school participates in an energetic composting program credited as responsible for rebuilding soil on this impoverished site. Worm farming consumes all classroom paper waste. The children undertake the routines of tending to the food garden such as watering in dry weather. Teachers and parents tend non-food gardens that have been developed in the school grounds. Infrequently community volunteers or local secondary students contribute to the food garden program, generally introduced from the Garden Specialist's community network. Teachers at School Three have developed personal gardens not related to food in bed areas adjacent to their classrooms.

The food garden is a food jungle of fruiting, citrus and nut trees. No dig beds are planted with vegetables and herbs for the kitchen classes. Other species are planted for microclimate management, soil improvement and attracting pollinating insects, complemented by species such as bamboo for building garden structures. Plans exist to develop a carbon sink garden along the western perimeter, and creating a covered play area with an avenue of native figs in anticipation the children's future needs in a warmer climate.

Participation in the garden program is highly regarded by the children. "Garden Ambassadors" lead the garden program and there is a peer-to-peer learning approach. Sessions are a privilege, withdrawn if classroom behaviour is unacceptable, additional access is granted as incentive. Early in the school year, prior to administration of the *National Assessment Program – Literacy and Numeracy* (*NAPLAN*) which involves students in Years 3 and 5, garden program attendance is regulated by teaching staff. As the year progresses children practice leadership skills and mastery of the garden routine, vying for permission to travel to other schools to demonstrate their gardening expertise. The children are aware of the outside interest in their garden from the frequent garden visits of other schools and stories about their garden published in national media.

The garden program arose from corporate funding provided to a secondary school and community of primary schools as part of a rehabilitation initiative for land impacted by its previous industrial use. 2013 was the ninth annual food garden program at School

Three. The founding and current Principals have given enthusiastic support for the garden program but school leadership support has not been consistently strong for the entire history of the program.

Corporate funding has ceased and the garden program funding is now drawn from the community of schools on a per capita basis. A senior teacher is employed one day per week to coordinate the school food garden network, develop an integrated curriculum and make applications to funding sources as they arise. The Garden Specialist, who works with a number of primary and secondary schools in the region, delivers the sessions from their own pedagogical initiative and has been employed commercially one day per fortnight from the earliest days of designing and developing the garden program.

In each school, delivery of the garden program had adapted over the course of its existence. These adaptations related to resourcing, population and experience changes within the school and as a result of the program. The impact local diversity would have on the application of the case study methods was yet to be experienced.

2.2 Methods

The validity of a mixed methods case study rests on the choice of methods and the integrated analysis of their collective outcomes (Hesse-Biber, 2010). Each method must be rigorously applied while the overall analysis is being conducted. Devices to promote a rigorous analytical process in this mixed methods study include allowing sufficient time and resources to undertake the analysis, discussing emerging results with other academics, returning to field diary notes for context or clarification, and working in an integrative manner to gain clarity from the theoretical model, published literature and data from other methods (Hesse-Biber, 2010; Minichiello, Sullivan, Greenwood, & Axford, 2004). While the methods described below were applied for the data they would generate, the school setting was simultaneously being observed and those observations systematically recorded as evidence. Settings observations were recorded as ethnographic evidence.

There are four data method groups: accelerometery; photography and video imaging; group and semi-structured interviews; and methods for the purposes of participant

description and observation. Methods will be discussed in terms of the rationale for inclusion, actual and intended data outcomes, and equipment and procedures applied in the data collection.

2.2.1 Accelerometery

Internationally, accelerometery has the confidence of physical activity policy makers (Beets, Rooney, Tilley, Beighle, & Webster, 2010; Van Sluijs et al., 2011) and is commonly used to evaluate school initiatives (Brockman, Jago, & Fox, 2010; Kipping et al., 2014; Taylor et al., 2011). Accelerometers are small robust devices that do not impede regular movement. The devices record acceleration in a single planar direction using piezoelectric sensors; generally vertical acceleration is evaluated (Chen & Bassett, 2005). Methodological decisions are key to understanding accelerometer derived information where the nature and context of the movement influence interpretation of device output (Troiano, McClain, Brychta, & Chen, 2014). Intensity is not a stable measure of physical activity but one which can be altered based on choice of measurement epoch – the sampled time interval in accelerometery terms – and the source of cut point sets that categorise intensity as light, moderate or vigorous (Esliger, Copeland, Barnes, & Tremblay, 2005). Manufacturer, model and wear-location also influence measures (Butte, Ekelund, & Westerterp, 2012; Ojiambo et al., 2011).

Accelerometers have great versatility for data management although the validity of their measures is dependent on the situation (McClain & Tudor-Locke, 2009). Accelerometers do not provide real-time feedback to the wearer; an important consideration. On the one hand, primary school studies have shown the potential influence of observation effect on physical activity studies (Simons-Morton et al., 1991). On the other hand, time-distance between the activity and data interpretation limits Health Promotion uses of this method precisely because users cannot be empowered with feedback. Including accelerometery provided an opportunity to assess the limitations and utility of the method for school setting Health Promotion purposes, as distinct from other purposes in schools such as population surveillance or behavioural science research.

Gardening has an uneasy history within physical activity measurement (Shephard, 2003). Early survey measures in adults had difficulties attributing energy costs to

gardening because it has high variability in energy expenditure and consists of a wide variety of activities (Armstrong, Bauman, & Davies, 2000). In response, an 'intention concept' was introduced to the discussion of physical activity, distinguishing leisure-time from occupational physical activities, and activity for health from types of activity that do not have a positivistically proven health causality. Such an intention approach is not consistent with conceptualising children's physical activity as active play – the work of children (Stokes-Guinan et al., 2011). Regrettably, the conceptual difficulty in applying 'intention' to children's activity does not stop the practice (Janssen, 2014). On balance, for children, the 'holism' of objective accelerometery offers a more rational alternative than codified 'intention' methods, although not one entirely free of its own conceptual limitations (Fairclough, Boddy, Ridgers, Stratton, & Cumming, 2011).

One purpose for including accelerometery in this study was to measure children's gardening physical activity in a way that permits contrast between physical activity undertaken in various school circumstances. The design of the study enables a discussion of measured levels of physical activity between sessions and across school programs. Accelerometery has previously been used to measure active learning lessons (Donnelly et al., 2009), outdoor schoolyard environments (Mota et al., 2005; Nielsen, Bugge, Hermansen, Svensson, & Andersen, 2012; Taylor et al., 2011) and curricular classes in Physical Education (Fairclough & Stratton, 2006; Mallam, Metcalf, Kirkby, Voss, & Wilkin, 2003), enabling a comparison of measured levels of physical activity to published values. Accelerometery permits the researcher to contrast different interpretations of activity such as when comparing accelerometer derived intensity categories to those collected simultaneously by direct observation (Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2007). This use of accelerometery enables the exploration and development of methods to translate objective and subjective understandings between lay and expert audiences.

Analysis of accelerometery data affords three opportunities to inform the setting question. It allows:

1. objective quantification of food garden sessions in different school settings to describe gardening as a source of school setting physical activity;

2. discussion on practical and conceptual aspects of using objective monitoring technology for Health Promotion purposes in the school setting; and
3. critique of the significant methodological choices necessary to monitor increased physical activity in this unique school context.

Equipment and Procedures

At School One, 24 children (nine boys, 15 girls) gave informed consent and assent to participate in the accelerometery study. Group size varied between garden sessions; 22 students were present and assenting at Session One and 16 students at each of Session Two and Three. A Core Group of 12 students were present and assenting across all three garden sessions. Two students withheld their assent for Session Two giving "low mood state" as their explanation.

At School Two, 61 children (31 girls and 30 boys) gave informed consent and assent. Three class groups were involved in data collection, some of which proved more useful as a piloting of processes in that location. The results from only one class group (26 children, 13 girls and 13 boys) are reported quantitatively in this thesis. Assent was not withdrawn by any of the children on any data collection occasions.

At School Three, accelerometery methods were not used. This was a decision driven by practical and ethical issues related to obtaining informed consent.

Actigraph Model GT3x+ accelerometers (Pensacola, FL) were used to measure the volume and estimate the intensity of students' physical activity. The accelerometers were initialised for data collection in three axes (Actigraph Software, Version 6.9.1) and worn at the hip in line with the anterior axillary line on elasticised belts placed on the outer layer of school clothing. A 10 second epoch was chosen anticipating short bursts of higher intensity activity thought to characterise the activity patterns of children (Trost, McIver, & Pate, 2005).

Data were collected on three occasions during regular garden sessions. Session One data were collected during the five consecutive days where students were wearing accelerometers for the entire school day. For Sessions Two and Three, accelerometers were distributed and collected at breaks before and after the garden session. Regular garden sessions lasted 45-60 minutes each week at School One and 45 minutes

fortnightly at School Two. Time synched video images established the start and finish times of each garden session, commencing with the Garden Specialist's briefing to the class and ending when fewer than five students remained in the garden.

Counts in the vertical axis per epoch for each student were exported into Microsoft Excel workbooks for analysis. To permit comparison between sessions of different duration and group size, volume of physical activity was expressed as total counts per person per minute (CPM), absolute minutes of physical activity and percentage of session time at each level of intensity. Excel worksheets compiled counts for each student present at each session. Quantitative analysis involved determining minutes in sedentary, light, moderate and vigorous physical activity categorised by a variety of published cut-point thresholds to make an informed choice of the most representative (Masse et al., 2005). These cut-point thresholds are listed in Table 3.2.

Schools were analysed separately. Group and subgroup values were computed from the individual results of the students that composed them. Group membership varied across sessions for the "Whole Group" but not for the "Core Group". The Whole Group consisted of all individuals present at a session while the Core Group consisted of only the individuals who were present for all three sessions, coincidently six boys and six girls.

In the absence of a clear rubric to steer choices (Bornstein et al., 2011), it was decided to calculate physical activity intensity using several different published cut point sets noted by the manufacturer. Sets were chosen for their development in age appropriate groups and related active living activities. The Freedson Children (FR) set was developed on children aged 5-16 years (Freedson, Pober, & Janz, 2005) and the Trost (TR) test group were in the age range from five to 15 years, weighted toward the older quartile (13-15 year olds) (Trost, Loprinzi, Moore, & Pfeiffer, 2011). The FR and TR sets arise from the same regression formula first published in 1997 (Freedson et al., 1997). They differ in that the FR cut points apply metabolic equivalent (MET) thresholds commencing at 3 METS for moderate intensity, 6 METS for vigorous, and 9 METs for very vigorous. By contrast, the TR has a moderate threshold at 4 METS and vigorous at 6 METS. Initially, a third set proposed by Evenson, Catellier, Gill, Ondrak and McMurray (2008) was chosen to diversify the formula of origin and on the

recommendation from Trost, Loprinzi, Moore and Pfeiffer (2011) of its superior estimate of energy expenditure. This third set was removed from the analysis when results proved to be almost indistinguishable from the TR set.

Cut point ranges were applied to identify the intensity categories of each epoch – sedentary, light, moderate and vigorous intensity physical activity. Results for the Very Vigorous category were inconsequential (fewer than 2 epochs) and subsequently incorporated with the vigorous category for analysis. Moderate and vigorous categories were added together creating a fifth intensity category, termed MVPA (moderate vigorous physical activity). The process was repeated for the FR and TR cut point sets.

Results of the accelerometry methods are presented in Chapter 3, along with descriptions of the specific analyses conducted to measure and raise measurement issues in conceptualising 'increase' in garden physical activity.

2.2.2 Video Imaging

Video imaging can be analysed to describe the physical activity of school food gardens using different methodological approaches. A qualitative descriptive approach can identify the nature of the physical activities occurring in the gardens, the social context and involves inferences made by the observer. A quantitative descriptive approach can identify the intensity of physical activity occurring in the garden. Each approach gives a unique perspective of gardening activity and what facet of physical activity might be being measured.

Observation is a fundamental scientific technique giving rise to both qualitative and quantitative evidence and explanations (Minichiello et al., 2004). Descriptive qualitative observation has a long tradition in Social Science and remains an area of development and growth (Platt, 1983). Before experimentation seeking causality, there was the natural science of observing what is (Gower, 1996), an approach still championed strongly in Health Promotion (Petticrew et al., 2005; Ramanathan, Allison, Faulkner, & Dwyer, 2008; Tudor-Locke, Ainsworth, & Popkin, 2001). Observation of this kind makes evidence of interactions and their outcomes (Minichiello et al., 2004).

Descriptive quantitative observation, by contrast, requires categorical abstraction of observations and has been used extensively to understand children's school hour

physical activity (McKenzie & Kahan, 2008; McKenzie et al., 1991; Sallis & McKenzie, 1991; Sallis et al., 2012). Quantitative observation has inherent advantages for the purpose of forming a translation between subjective judgements and objective technologies. It requires making sense of physical activity intensity from observed sources and resolving this with categories drawn from objective sources of evidence such as accelerometery.

Video imaging facilitates observation techniques by producing a stable time-distant source of evidence for analysis. In the context of this study, where the setting was novel and the optimal choice of analysis technique unknown, there were several advantages of this time-distance that recommended the use of video imaging methods. First, video imaging resolves pragmatic data collection issues, as real-time analysis makes it difficult to analyse moments of physical activity from multiple simultaneous techniques. Video allowed a return to the action any number of times to observe from new perspectives. In novel exploratory situations, where observation opportunities are limited and infrequent, the ability to revisit action after gaining greater understanding was invaluable.

Importantly, video reduced disruption to the Actors in the garden and permitted observation of more interactions than might be able to be observed in real-time. Returning to the images on multiple occasions allowed opportunities to be reflexive across several levels of meaning serially, to understand significant setting influences progressively. This reflexive time-distant analysis allowed for thorough consideration of the observation data as evidence.

Qualitative descriptive observation provides evidence of physical and social contexts as well as the physical activity or human interaction within them. The method identifies pertinent exogenous factors, actions, interactions and outcomes in the setting under investigation. Video imaging helps the researcher to manage flooding from the fascination and playfulness of school children engaging with a visiting adult. The qualitative evidence, like that from interview sources, is constructed between the students and the researcher in the moment of capturing the video and interpreted through the researcher's lens during the subsequent observation and eventual analysis.

Equipment and Procedures

Food gardening sessions were recorded in School One in one class group during three sessions in June, November and December and in School Two in three class groups during three sessions each fortnight throughout August. The composition of each class group changed for each session. All students in the descriptive observation methods are boys and girls in the range of 10 to 13 years of age. Table 2.3 describes the consented student groups by site, age and gender.

Table 2.3 Description of participants in descriptive observation groups

School Site		Male Students		Female Students	
	Class	Number of Students	Mean Age (Age Range)	Number of Students	Mean Age (Age Range)
School One	Grades 4/5/6	9	11.7 yrs. (10-12.5 yrs.)	15	11.2 yrs. (10-12.1 yrs.)
School Two	Grades 5/6	30	12.4 yrs. (11.1- 13 yrs.)	31	12.4 yrs. (11.2-12.9 yrs.)

Four Panasonic Lummox DMC-FH8 digital cameras and one JVC Everio GZ-MC500 video camera were placed on SLK F153 Tripods around the garden with overlapping fields of view. This placement enabled the capture of continuous activity, often from opposing perspectives, to facilitate observation of the many people acting in the confined spaces of the garden. The cameras were not concealed and all consenting and assenting children were included in the analysis.

For the descriptive qualitative observation there was no post production of the images. Video images were viewed using Microsoft Media Player on a 340mm x 600mm Acer monitor. Analysis of the video images was undertaken to produce an interpretive description of the gardening classes and the physical activity undertaken by the students. The images of the garden were analysed from each camera angle in a minute-by-minute timeline of the session. Descriptive narratives of the sessions were created from these timelines.

Results of the descriptive observation analysis from video imaging methods are presented in Chapter 4.

2.2.3 Time-Lapse Photography

Photographic methods were introduced to observe the use of the food gardens outside formal sessions. Time-lapse photography presents an understanding of the garden use, silently removed from the enthusiasms of subjective recounts. Photography grounds this study in rigorous observation, makes salient significant aspects of the use of school food gardens, and enriches the subjective process.

Time-lapse photography has been used in educational research settings for over 50 years (Bingham, 1967; Withall, 1956). It involves imaging a scene with sequential photographs at a set interval then playing the images as a stop-motion animation (Bingham, 1967; Persohn, 2014). Persohn (2014) recently used time-lapse photography in the school setting and noted the ease with which patterns in events were discerned – specifically she commented on "the amount of time students spent moving about the classroom vs. sitting still (p.6)" – transition time between activities and evidence of routines.

Time-lapse photography has the potential to enrich understanding of how gardens are used across the whole school week, enabling an assessment of the potential of increased use of the garden as a pathway to increased physical activity.

Equipment and Procedures

Images for the Time-lapse method were taken in School One and 2 on five school days, during extended school hours (8.30 am to 3.30 pm). Signs were erected to notify members of the school community that images were being taken. Each School Principal gave written consent to photographs being taken on school grounds. Viewing of images was restricted to research personnel and the Principal.

Images were taken using a GoPro Hero 3 Black camera (Woodman Labs Incorporated, California) equipped with an additional GoPro Battery BacPac (Woodman Labs Incorporated, California) recharged continuously throughout the day via a 5600mAh Power bank (Unidentifiable supplier). The camera was mounted on an Inca i350 tripod

(Inca Incorporated) using a GoPro Mounting with extended back portal to accommodate the extended battery and permit cable access. Images were recorded to a SanDisk 32Gb micro SD (SanDisk Corporation, California) and transferred at the end of each day's shoot to a Seagate 2 Terabyte Expansion Desktop SRD00F2 for analysis on a 2.5/2x4G/500Gb Mac Mini. Final Cut Pro X Version 10.0 was used to create the stop animations.

Camera set up optimised coverage of the highest use areas of each garden without creating obstruction. The field of view was established from WiFi control of the GoPro using an iPad and GoPro software. The Time-lapse Option was selected with screen set to '7Mp wide' and a 10 second interval. An Apple iPad with MovieSlate HD application was held in front of the camera for the first and final images to embed project name, time clock and date fields in each series.

The micro SD card was downloaded each evening, transferring all Joint Photographic Experts Group files (.jpg files) to a unique control series folder on a password-protected computer. Files were imported into a new Event by school in Final Cut, each series a new Project. The .jpg files of each series were brought into the timeline and the duration set to three frames. A composite clip was created and exported in Apple's proprietary QuickTime program MPEG 4 video container file format (.mov file) for qualitative analysis. A narrative analysis describes patterns of activity of persons and groups entering the garden.

Results of the Photography methods are presented in Chapter 4.

2.2.4 Qualitative Interviews

Photo elicitation and Group Interviews with Children

Photography as a free elicitation method prior to group interview has several features to recommend it in a primary school setting. The novelty of the method prompts students beyond the reproduction of learned responses (Close, 2007). School communities are a complex balance of relationships and photography represents a way in which the students may demonstrate their expertise while remaining 'respectful' of a declared interest of an adult guest in their school. Openly questioning students about immutable aspects of organisational level policy, such as permissible access to the garden, creates a

risk of disturbing their sense of satisfaction and well-being. Free elicitation techniques provide an opportunity for these charged issues to be emergent, if they exist or are important to the students (Mengwasser & Walton, 2013). Photo-elicitation was included to facilitate communication of the students' subjective perceptions of physical activity and health in the school food garden

Equipment and Procedures

Group interviews with children require substantial skills in facilitation (Drew, Duncan, & Sawyer, 2010). A qualitative researcher must build rapport and ensure the discussion reaches a reflective level, and allow free expression in the face of distractibility and impulsivity. They must seek the input of less articulate children while remaining sensitive to all children's experience of distress in reaction to their contributions or performance in the group (Goffman, 1990). Sensitivity to the different ways in which children demonstrate distress is essential. Child friendly practices include choice of interview environment, pacing of discussion, setting collaborative group norms and use of inclusive, supportive verbal and non-verbal communication. There is the risk of social dysfunction developing after the interview in which case help from school staff is needed for successful mediation.

The photo elicitation method was conducted at School One and School Two. Students volunteered, however volunteers were vetted by the class teacher – an unavoidable situation that could not be negotiated. At School One the group consisted of seven students, girls only. At School Two participants were two boys and two girls from each of the three Stage 3 classes to make a group size of twelve. There were no drop-outs per se, however each child's engagement and participation fluctuated. Written consent was obtained from people in the students' photographs. The intended use of images in a presentation to the class group and school community was fully disclosed.

The students were instructed on how to use the equipment, basic photography, and the principles of making photographs expressive of emotions and abstract ideas. To stimulate their conceptualisations for the task, the group discussed their meaning of the terms 'physical activity' and 'health'. They were asked to:

Take pictures of what it is like to have a school garden. Take pictures of different objects, people (if you obtained permission from them), and events showing your thoughts and feelings about what the garden means to you and the other kids in your school for your health, as well as what things in the garden are about physical activity.

Friendship groups formed around the available camera equipment. These groups moved out into the school and garden area to create images then came back together to discuss them. The process was repeated to create, select, and discuss specific photographs thought to be the most important. In School One the subgroup created presentations to their classmates. In School Two images were made into a slideshow to accompany their annual entry at the local agricultural show.

Group interviews were recorded digitally with the consent of all present using a Philips Voice Tracer and 360^{o} Boundary Layer Microphone (Philips Incorporated). Field diary entries were made immediately after each interview and in later reflection sessions. The entries were analysed in conjunction with partial transcripts made from the recorded interviews. The language of children in a group interview was not always coherent in transcript. Themes were identified within four domains from in vivo coding; NVivo software Version 10 (QSR International Pty Ltd., Melbourne) was used to assist the coding process. The domains were: the children's perspective of the garden's relationship to physical activity and health; the potential for increased garden physical activity; health outcomes attributed to garden physical activity; and the concept of the Health Promoting School. Qualitative concepts of truthfulness and rigour (Denzin & Lincoln, 2005) require the students' tone and intention be captured without preconception. The analysis attempted to preserve the essence of the material generated within the group sessions (Liamputtong & Ezzy, 2005) which required some quotes to be attributed as the shared construction of several children collaborating to produce a single recount.

Semi Structured Interviews with Staff

Whether or not evidence can be found to demonstrate an unrealised potential to increase physical activity in school food gardens, the particular ways in which garden physical activity impacts on health become important in understanding the school setting. For this reason, an issue-focussed, semi-structured interview technique was chosen to

explore the staff's subjective meanings and interpretations of the garden and its contributions to school setting health. Alternatives to the semi-structured interviews, such as short and long response questionnaires, are constrained by their potential to introduce a concept of 'one knowledge'. Such interpretations extinguish the opportunity to reveal possibilities of the garden and, instead, are seen as an assessment of the completeness of the staff's learning, training or knowing (Rice & Ezzy, 1999).

Semi structured interviews were included as a method of the case study because they have the ability to garner a subjective perspective in the essential voice of school food garden participants. Conversations with the teaching and garden staff who implement the programs, school leadership and other significant people within the school community have much to reveal about the pragmatic aspects of translating potential for physical activity into reality and how garden physical activity is related to health.

Despite the wellspring of enthusiasm for developing food gardens in schools, those gardens often only exist as temporary instalments (Somerset & Bossard, 2009). Yet, high turn-over, substantial capital outlay and significant investment of programming time and expertise do not seem to extinguish interest in establishing food and kitchen garden programs (Eckermann et al., 2014; Yeatman et al., 2012). The beliefs and attitudes of the school stakeholders are likely to be key in the decisions that impact on the sustainability, and therefore the physical activity potential and outcomes, of these garden initiatives. For this reason, semi structured interviews, which have a great facility to explore beliefs and attitudes, were included in the case study.

Equipment and Procedures

A semi structured interview method was used to allow the perspectives of the participants to emerge. The interviews asked the garden stakeholders to speak generally of the relationship of the school food garden to health before specifically questioning the participants on the potential of food gardens to increase physical activity.

Interviews were conducted with garden program stakeholders working within the case study schools, including the school principals, garden program classroom teachers, and kitchen and the Garden Specialists from all schools. At School One the previous school principal and current cross-sector facilitator, who was a past chairperson of the Parents

Group, also gave interviews. Interviews were conducted during the later study visits in each school. Each participant signed an informed consent form giving permission for the interview.

The interviews were conducted in comfortable convenient locations within the schools including offices, staffrooms, classrooms and the garden itself. Each participant was asked for permission to digitally record the interview and was offered a copy of their interview recording. Recordings optimise information gathered from interviews. All agreed to the recording, one asked to be given a copy. A Voice Tracer and 360^{o} Boundary Layer Microphone (Philips Incorporated) were used for the recordings.

Interviews were a maximum of 60 minutes in length. Immediately after the interview an entry was made into the research field diary capturing additional information to retain an accurate understanding of the interaction. The recordings were reviewed. It was clear from the detailed, flowing nature of the discussion that participants were speaking reflectively and there was no indication that a change in interview technique was necessary. The interview schedule is included in Appendix A.

The semi structured technique uses an initial schedule of questions to assist the dialogue but without undue reverence to the order of the questions or their specific wording. Question prompts are used to encourage a comprehensive coverage of topics and to stimulate discussion in a preconceived means to avoid the imposition of unintended constructs from the interviewer. The interview schedule may evolve and be refined as perspectives are further revealed from the experience of initial interviews. This schedule did not. That being said, the form of the sentence the question is presented in, the context of the preceding discussion, and the pathway of the overall discussion, differ with each interview in response to the different relationship developing. Handled in this way, the interview is a useful and meaningful experience for both parties (Liamputtong & Ezzy, 2005).

Transcriptions of the interviews were made by an assistant who was signatory to a non-disclosure agreement and experienced in the transcription of group discussions in Public Health. The investigator who had conducted the interview reviewed the transcriptions and recordings concurrently to assess accuracy. Transcripts and field diary entries were imported into NVivo Version 10 (QSR International Pty Ltd., Melbourne) to be

analysed thematically. Results of the analysis revealed concepts related to the research questions of Setting and Theoretical Levels.

Results of the Qualitative Interview methods are presented in Chapter 5.

2.2.5 Measures for Description and Observation

An activity recall diary method, grip strength, broad jump, height and body weight measures were approved and conducted as described in the ethical review. Each of these methods permitted interaction with the school community and provided challenges and common Health Promotion experiences through which to understand the school setting. Experiences encountered while conducting these methods are included in the field observations subsection to follow, however, the data collected has not been analysed for the purpose of this thesis.

2.3 Perspective of the Schools Setting

School settings are immensely personal places for the people who make their lives in them. Schools are a workplace, a constant, a threshold, the culmination of a career and a place that never seems as big as you remember when you return later in life. Before considering the school setting from dispassionate empirical and theoretical perspectives, it is important to pause and consider some of their subjective reality as a setting. This section describes an understanding of the formal setting interfacing with its personal role and the process used to develop that perspective.

2.3.1 Method

This mixed-methods case study was undertaken enabling an ethnographic observation of the school setting. To this end, a Research Diary was kept from the very first covering the period where the data methods were being proposed, selected, mastered, approved, negotiated, conducted and analysed in the study schools. The purpose of the diary was to collect data on encounters and experiences faced in the course of conducting Health Promotion research in the school setting. These were analysed for issues pertinent to working in the schools setting.

The diary had the purpose of capturing event descriptions, emotional recounts and relational notes to become part of the evidence for challenging the development of Health Promotion theory. The diary began as a collection of literal descriptions relating to the method and grew to include progressively more analytical writing. Initially events of the day and interactions engaged in or witnessed dominated the content. An understanding of the school setting begins with an understanding of the school system context and organisations that grant access. The diary notes included emotional responses felt and observed, reflective insights on the day's experiences, academic and related readings or study problem solving. It was a repository of relational notes in diagrammatic form, many building information on concepts expressed in Health Promotion theories, showing flows of importance and attention.

Reading work on writing ethnographic field notes led to a more formalised approach to the diary after the first few weeks (Emerson, Fretz, & Shaw, 2011). Emerson, Fretz and Shaw (2011, p.1) extol the practice of noting, stating in:

regular, systematic ways what she (, the researcher,) observes and learns while participating in the daily rounds of the lives of others… (As a result)… the researcher creates an accumulating written record of these observations and experiences.

The first prolonged encounters with the school setting in a researcher role began with the data collection in schools where the diary entries became focussed on the contrasts between the expectation of the school setting and the experience of researching within it. As the research progressed the diary entries moved from a simple recount of vignettes to a deeper set of abstract and philosophical ideas reflecting the emergence of a less episodic understanding of the school setting and the development of a more truthful – possibly generalizable – perspective.

Reflective analytic work related to theory advancement was written concurrently with the more objective pragmatic field observation diary, both recorded in the same assortment of places. Diarising was done on site directed by a series of headings (description of the garden; resources; program; rules; behaviours; communication; non-attendance by participants; special activities and weather; procedural problems or methodological challenges; reflective comments). Analytic writing was less commonly done on site, often a few jottings to inspire later contemplation. It was generally

undertaken in the evenings after leaving site or in the staffrooms during the down times of data collection.

The entries include notings of vignettes or observations of actual happenings in the garden, school or study process, observations of values, emotional elements and ethics the participants (including myself as the researcher) were enacting or professing, simple musing, recall of the interactions occurring within the community and discussion of the implications of that communication, and associative writing on truthfulness. The diary was prefaced with two instructional quotes. The first is a quote from Nye (2003) recommending the philosophers weapons of "logical refutation, hostile counter-examples, and on occasion dismissive parody ... (progressing to) understanding, amplification, and explication." (Nye, 2003, p.144). The second quote is attributed to Oliver Wendell Holmes, Snr "I would not give a fig for the simplicity on this side of complexity, but I would give my life for the simplicity on the other side of complexity."

This flexible systematic approach made it possible, in reflecting on the day's observations and events, to bring order to their richness and preserve the importance of their confusion.

2.3.2 Results

Working in the school setting requires sensitivity to the regulations, norms and relationships of the school community. It requires respect for the knowledge and capabilities of school community members. Schools need long term, iterative commitment to engaging children. If one accepts that schools exist for the central purposes of educating and socialising, then involvement in Health Promotion programmes must endow schools with capacity to continue to create academic or social benefits for their school communities. The school setting is an energetic social environment challenged with an expectation of outcome constancy.

From this the case study process, the program and the school setting became understandable through four domains: school interactions, program histories and delivery, social relationships, and working with children. Working with children includes discussion of the ethical and practical aspects of conducting this case study.

School Interactions

School settings are part of a multi-level education system. In NSW, different schools are administered and organized into a number of State Government and Non-Government school sectors. The State Government is responsible for school accreditation in all sectors. Accessing schools in the different sectors to conduct research requires compliance with their different approval processes. Schools from different sectors have little interaction even when located in close geographical proximity. There is competition for enrolments and a rivalry between sectors evident in conversation with school community members.

Schools within the State Government sector cluster geographically into what are called 'Community of Schools' groups. These are predominantly communities of school Principals. Executive and senior staff might participate in Community of Schools' activities if these coincide with their school-based responsibilities. Students are probably unaware of the formal nature of their Community of Schools.

The school setting is a highly regulated environment in which to conduct Health Promotion initiatives. Staff and volunteers in NSW schools agree to have a daily criminal record screening as a condition of obtaining clearance to work with children. There are procedures to enact in schools in the event that a child discloses information that suggests reportable conduct or acts of violence or risk of harm. The *Protecting and Supporting Children and Young People Procedures* of the NSW Department of Education and Communities process begins with notification of the School Principal. The procedures are thorough however they still require judgement decisions. While a Principal's formal responsibilities are ascribed by the procedures, an informal responsibility is judged in the eyes of the school community. This is a risk the school principal takes when there is agreement to engage with outside.

No contact with schools concerning evaluation and research is permitted in the NSW State Government sector prior to approval from the central approval system called the State Evaluation and Research Approvals Process (SERAP). This holds even for the purpose of improving questions or design. The SERAP process is aligned with institutional ethical review. Programs are introduced into individual schools by the consent of their School Principal.

Program Histories and Delivery

Schools have a myriad of formal and informal program histories. The influence of principals' program choice endures within schools long after the termination of a program. That influence remains in the form of intellectual property in teaching and learning materials, capital and infrastructure, or policy, standard operating systems and outcomes. Teachers are mobile between schools. Their exposure to programs builds a personal knowledge and experience base. Program training is not uniform for all teaching staff. Peer to peer learning and train the trainer style approaches seem to be practised. In-servicing of active teaching staff takes place on both a local and State wide basis. Staff mobility plays a part in disseminating program influences to new workplaces. Their resources are a collection of favourites and remnants from previous change initiatives, including HPiS, interventions, and curricular and co-curricular programmes.

Discussions in the Public Health literature suggest a common belief in standardising implementation or translation of program initiatives (Glasgow, Lichtenstein, & Marcus, 2003). Discussions such as these seem to ignore differences in setting capacity arising from each school's unique history of program learning, volatility in the school community and staff stability. From a purely pragmatic perspective, given the unique biophysical and social environments of each school, the extent of standardisation possible in these garden programs is open to question. Soil, climate, community characteristics, competing program interests are all school factors which are inescapable and resistant to standardised program implementation. Program sessions are scheduled at different times, intervals or durations, interrupted by significant events unique to each school calendar and the garden designs are highly idiosyncratic. Without information on the impact of these school system variables, asserting an incompletely standardised implementation seems superfluous given it cannot form the basis of a probabilistic claim on generalizability (Glasgow, Klesges, Dzewaltowski, Estabrooks, & Vogt, 2006).

Working from within the school community entails fewer barriers to delivering initiatives than entering the school setting as an outside agent. Undoubtedly there are Health Promotion initiatives that school community members, particularly teachers, are

better placed to deliver, however this should not be interpreted as school insiders having the capacity to conduct programs at the behest of outside agents. A real concern is the imposition of non-curricular program objectives on class time. During the course of the interviews, teachers openly expressed pride in their diverse skill set and even suggest that the agility, creativity and capacity of primary school teachers are boundless. Stepping back from the hyperbole however, they also express a concern over the amount and diversity of material they are expected to cover in class. There is an expectation at each of the study schools that members of staff will champion and assume leadership responsibilities for program activity in addition to their regular classroom duties. Both managing a strategic program mix and curtailing the growth of extra responsibilities have potential to impact on the Health Promotion opportunities of the school setting.

An argument can be made for the delivery of Health Promotion initiatives by school staff members to avoid the ethical challenge of obtaining consent; evidence supporting this was witnessed in the course of this study. Teachers, as inside providers, do not have to exclude children who have not specifically provided consent for general school activities. During this study I observed an at-risk child being supervised in the garden while classmates attended a health education session from an external program provider; the child had not provided written permission or the small cost of the session. Staff had a philanthropic mechanism to cover the cost but they had no way of circumventing the need for parental permission for participation because a child must opt in to external programs rather than opt out, as is the case for internal curricular programs. Identical content delivered by the teacher would not have resulted in the at-risk child being excluded from the program session.

In the school setting the issue of consent is closely related to literacy. School parent communities are diverse in their literacy skills and language backgrounds and effective communication requires learning the group's capabilities. Schools develop masterly processes for communicating information to parents and documenting permission, however their methods may not be sufficient in the eyes of external agencies evaluating research proposals in schools. While external agencies focus on using language to make consent materials understandable to a general community, schools focus on using language to make information understandable to members of their community. Schools

have a keen understanding of the history of communications strategies that have been successful with their community. Schools communicate with their school community in a highly ritualised way to facilitate comprehension. They apply their knowledge of families at risk and customise their approach on behalf of specific children.

Social Relationships

Schools are institutions with complex social structures. Relationships among stakeholders are a primary consideration. Staff seniority is hierarchical, awarded formally based on merit and attributed informally based on standing and contribution to the school community. School staff members, including teachers and program specialists, reported they were commonly employed on casual contracts, staying on these contracts in some places for a series of years. Temporary teachers are called on from a school-based list. The uncertain terms of employment contracts, for even long serving staff members, amplifies relationship issues and social complexity. A cohesive staff room environment is highly prized by staff and members of the school community. Entering a school setting must not intrude on these relationships.

Principals have the responsibility to manage the politics of their school community; even a perception of transgressions in the school setting can have unpleasant and limiting consequences; introducing potentially disruptive influences into the social mix is a risk principals take when permitting outside agents to be active in school programs. However, minimising external programs in a school setting does not automatically minimise risk to the social structure of the school. School staff members also value novel opportunities that reduce intellectual isolation and allow them to demonstrate the strength of their professional persona.

Interactions in the school setting may have important meanings that remain hidden to external agents. Significance can go unrecognised except by members of the school community. During this study, while waiting for a session to commence, an exchange occurred between two students leading to one student enacting a pre-scripted behavioural intervention strategy. For my benefit, the student group gave their interpretation of the situation as it unfolded and halted any ill-informed intervention on my part. This vignette demonstrates the strength of the school community in enacting solutions. The school setting is a stabilising environment for many children and

disruption to their school relationships is a risk. Recognising what constitutes a transgression takes experience within a social group.

Home-to-school relationships are precious and vulnerable. In this study, the teachers were adamant there should be no impact on the home-to-school relationship from unreturned loan equipment or any embarrassment to the child from information on height or weight. So, while maximising accelerometer wear-time would have been served by a prompting system to remind the return of equipment, the teachers rejected it. Their concern was that, in the eyes of the school community, the school takes responsibility for burdens imposed by outsiders. Standardised implementation and protocols are in effect disempowering school personnel from making adjustments and taking responsibility, especially where it is parents who have signed consent and been given assurances through the information sheet.

Relationships in this setting have profound effects on all parties. The case study schools graciously bore substantial interruption to their classroom schedule for this research program. They opened their doors, gardens and the hospitality of their staff rooms and workplaces to an endeavour that made no promise of a favourable report. They deflected gratitude for this access, one teacher describing it as a hallmark of their professionalism. Returning to the school setting as an outside observer of the school community member was an edifying experience. Although overall a very warm and productive setting, finding oneself the essentially powerless observer of food insecurity, absent parenting, social exclusion and inadequate health and welfare system response is distressing. The importance of school settings to the health and well-being of people within them rests in them remaining and developing as effective, amiable and welcoming environments.

Working with Children

Child participants cannot be approached in the conceptualisation or design stage prior to the granting of ethical approval. Continued approval for a project is contingent on conducting the research as described in the application. This means that outside agents are limited by the mechanics of the approval process in customising extemporaneously as they gain knowledge of the school setting and are unable to design a best first approach to particular school communities.

The physical activity recall diary is an example of this and all three case study schools had existing knowledge resources relevant to the photo elicitation process with which the children were already familiar. Had there been the opportunity to work with the school these resources would have been better.

The students of this study enjoyed assessing equipment that enabled them to test their own height, grip strength and broad jump; while they had an indifferent response to waist measurement. None of the study information could be made available to them so they took every opportunity to mimic the research methods and assess their own results. At one school, while waiting for data collection, the children gathered height data on school equipment for an upcoming mathematics exercise. Whilst I was ensuring compliance with the confidentiality and privacy issues of my data, they were making a game of how high and low they could make their own height readings based on non-standard posture. None would argue that preventing comparative physical activity data being shared with the students except as de-identified and group level data was in the students' interest. At times, the extra constraints seemed irksome or amusing to the teachers, especially when the restrictions applied to behaviours or tasks commonly undertaken in classrooms. At times data security measures seem ridiculous, with one exception.

Children exhibited concern when having their weight recorded. Surprisingly, those children who expressed concern were not necessarily the children one would deem presently at-risk. In health spheres height and weight are spoken of almost as a couplet, BMI a contraction; however, taking these two measurements in the school setting were worlds apart in terms of sensitivity and risk. Weight results had to be recorded in code to prevent aggressively curious peers gaining access to meaningful information. One such attempt employed means that were highly devious, beyond what even this mother of two collaborative, scheming siblings ever imagined likely. Boys and girls asked for their weight information nervously and were dissatisfied with the deflection of the question. Critique of body weight was undertaken with great ferocity and had started by the fifth grade.

Children's assent has a fascinating collection of labels and indicators in the schools setting. It is termed student attendance rate, program participation, academic

engagement, attention or attention deficit, and a host of other pro-social descriptors such as focus or achievement. Understanding the potential of the school setting for Health Promotion is inextricably linked to understanding what might encourage children to act on their assent and participate in activity opportunities.

The students enjoyed the novelty of festooning themselves in camera markers to uniquely identify themselves as having provided consent. They made trophies out of the wrist bands with which accelerometers were fixed to the wrist. Yet, at other times, individual students were physically present and completely detached in their behaviour. There is a palpable difference in energy of a group across the course of a school day. On occasions, debates around the mulch pile and compost heap were a highly developed ruse to extend periods off task. Children's participation in the school setting can be overwhelming in either direction.

The perspective of school settings revealed through the conduct of this case study has clear implications for the development of Health Promotion theory. A settings approach to Health Promotion in schools requires acknowledgement of the unique qualities of these important places.

2.4 Chapter Summary and Conclusion

Chapter 2 introduced the sites, methods and context of this case study. The process by which schools were recruited was explained. Consenting case study schools were described. Rationales were presented for each specific data method and their procedures. A perspective of the school setting was related to explain the case study schools as personal places ahead of the objective frame to be applied for the accelerometery method.

The diversity of program forms, discovered in revisiting these successful, established initiatives, draws into question practices that seek to regulate program implementation, promote uniformity and suggest a homogenous translatability is in the best interests of successful outcomes. Local differences were evident in the efficacy of applying data methods and establishing the information that would need to be used as the basis of judging a program's success. These three sites were unique settings, measuring program

outcomes at each site presented unique issues and it was yet to be seen whether the results of each site would also prove to be unique.

3 ACCELEROMETRY OF SCHOOL FOOD GARDEN PHYSICAL ACTIVITY

This chapter is the first of the analysis chapters. In association with Chapter 4 it identifies potentials for school food gardens to increase physical activity and address the first research question posed for this study: *Do food gardens in schools have the potential to increase physical activity?* Together Chapters 3 and 4 establish the empirical case for developing method, methodology and theory for the unique purposes of Health Promotion.

Specifically, Chapter 3 tests the premise that school food gardens are sites of physical activity. It presents a critical review of previous work measuring children's garden physical activity using accelerometers. It reports a series of accelerometery studies from two case study schools investigating potentials for increased physical activity from school food gardens. Three potentials are identified. The case for mixed methods methodology is confirmed and exploration of between school differences by means other than accelerometery is proposed for the following chapters.

Accelerometery is a trusted objective measurement of children's physical activity (Butte et al., 2012) and is the first method employed in this case study to test whether school food gardens have potential to increase physical activity. The critical review of past accelerometery studies in school food gardens will explore whether, with purposive and intelligent application (Bornstein et al., 2011), accelerometery is a method that may serve Health Promotion purposes.

The second section of this chapter reports an accelerometery study seeking to confirm or deny the potential of school food gardens to increase physical activity. Critical discussion of the results will reveal how procedural choices in the method influence understanding of the potentials for increased physical activity and will challenge isolated accelerometer data in the evaluation of physical activity for Health Promotion purposes.

The third section of this chapter discusses method and methodology as regards the unique Health Promotion objectives of observing physical activity from school food gardening. It concludes Mixed Methods methodology is necessary for the purpose of

collecting physical activity data in the school food garden and producing analysis that is meaningful from a Health Promotion perspective.

3.1 Previous Accelerometer Studies of School Food Garden Physical Activity

The health of children is compromised by problem nutrition, insufficient physical activity and excessive sedentary behaviour (Caballero, 2004; Janssen & LeBlanc, 2010). In the schools setting, evaluation of initiatives that promote children's physical activity using sports and games are common whereas those promoting non-sport active living have emerged more recently (Dobson & Maddock, 2004; Mendoza et al., 2011; Murillo Pardo et al., 2013). Schools and playgrounds are valued as important places in children's active lives (Mota et al., 2005; Nielsen, Taylor, Williams, & Mann, 2010; Parrish, Okely, Stanley, & Ridgers, 2013; Ridgers, Stratton, Fairclough, & Twisk, 2007; Stratton, Fairclough, & Ridgers, 2008) but much less is known of the food garden spaces within them.

Currently, the evidence tells us very little about what children do when they are engaged in the school food garden and there is a need for objective measures of children gardening, approached from a Health Promotion perspective (Hermann et al., 2006; Yeatman et al., 2012). Volume and intensity data are customarily used to distinguish sedentary behaviour from physical activity (Lubans et al., 2011). It is necessary to establish whether school food gardens are currently a site of physical activity before judging any potential they may have for increase.

Previous research into physical activity in school food gardens includes a limited number of objective measurement studies (Domenghini, 2011; Kien & Chiodo, 2003; Oosman et al., 2011; Wells et al., 2014). The majority of school garden research has been designed using subjective measures (Findholt, Michael, Jerofke, & Brogoitti, 2011; Hermann et al., 2006; Ozer, 2007; Phelps et al., 2010; Somerset & Bossard, 2009). Objective studies have been conducted to demonstrate the energy expenditure of children performing specific isolated gardening tasks (Park et al., 2013; Ridley & Olds, 2008) or as part of a mixed activity program with food gardening only one component (Domenghini, 2011; Jacquart et al., 2010; Kien & Chiodo, 2003).

Despite their limitations, each of these studies supports the notion that gardening has the potential to provide some physical activity of at least moderate intensity. The metabolic methods previously used in child gardening studies (Kien & Chiodo, 2003; Park et al., 2013) are prohibitively expensive and disruptive for observations on class size cohorts measured on multiple occasions at multiple sites. Accelerometery, by contrast, used as a proxy estimator of energy expenditure and intensity (Adamo, Prince, Tricco, Connor-Gorber, & Tremblay, 2009), is relatively non-invasive and more economically achieved.

The purpose of this review is to describe the current understanding of physical activity in the school food garden measured by accelerometery, critique methods previously applied, and identify ways the design of future studies could be improved. The search strategy is described in Appendix B.

Search Strategy

Four studies constitute the published accelerometery research in school food gardens. They are a program evaluation article (Kien & Chiodo, 2003), accelerometery chapters from two doctoral dissertations (Domenghini, 2011; Oosman et al., 2011) and the protocol and results article (Wells et al., 2014) of a randomised control trial conducted at 12 American schools.

None of the four studies of this review is a report of the physical activity of school food gardening as it is currently commonly promoted in Australia through organisations such as the Stephanie Alexander Kitchen Garden Foundation (https://www.kitchengardenfoundation.org.au). They measure out-of-school-hours, mixed activity sessions which include periods of gardening of unknown duration (Domenghini, 2011; Kien & Chiodo, 2003) and/or they have evaluated the impact of a garden education program by measuring the whole school day-segment physical activity of children who have been garden program participants (Oosman et al., 2011; Wells et al., 2014). Whether school food gardening sessions provide school food gardeners with any measure of physical activity remains unknown. Whether this garden physical activity, if it does occur, increases their overall physical activity also remains a point of conjecture.

The four accelerometery studies of garden programs are now addressed in turn.

3.1.1 Wrist-borne Accelerometers in a Mixed Activity Obesity Program

The study by Kien and Chiodo (2003) describes an outdoor program aimed at reducing sedentary behaviour in a clinical population of overweight and obese children. School food gardening was nominated as a component of their hospital sponsored out-of-school-hours program. Two experiments were conducted using wrist-borne accelerometers. A doubly labelled water technique was simultaneously applied to measure energy expenditure. The first experiment compared two hours of program participation to two hours of video watching; the second experiment compared two hours of program participation to two hours of habitual activity around the child's home.

The study included a small number of subjects (N = 4 & 8) aged 10-12 years, selected based on high attendance (over 75%) at the after school program. The children were aware that the evidence being collected would be used to judge the effectiveness of their program and were paid a stipend for participation.

The outdoor program typically ran for a two hour period and included approximately 60 minutes of adventure games and between 30 and 45 minutes of gardening (including planning, planting, and attending a local farmer's market). Gardening results were not isolated from the adventure education component (including sports skill building activities and teamwork games).

Wrist-borne accelerometer counts per minute for the outdoor games and gardening program were reported from the first experiment as 3959 ± 896 (mean ± SD), significantly more than the 513 ± 182 (mean ± SD) counts per minute for watching a videotape. The second experiment recorded counts per minute of 4578 ± 1004 (mean ± SD) for the outdoor program and 2345 ± 746 counts per minute (mean ± SD) for habitual home behaviour. These counts can only be understood as indicators of volume as no categorical description by cut-point set was described.

The Kien and Chiodo (2003) study included compliant participants who may be considered to have acted in their own interests and the interests of a program with which they had a long personal association. However, it is important to acknowledge that existing relationships and reactions may be the mechanisms by which children are

internally engaged and motivated to participate and move (Smith, 2003); that individual and group engagement might be significant in maximizing physical activity on singular occasions (Engelen et al., 2013); and that these are exactly the mechanisms which make schools important settings for effective health promotion to children (Weiss, 2000).

Kien and Chiodo (2003) declared their interests lay in sedentism reduction and energy expenditure expansion. They rationalized that substitution of inactivity for any activity of greater intensity is a valid strategy to promote their ends. Interest in sedentary behaviour now stands as a legitimate research focus and target measure of guideline approaches (Commonwealth Department of Health Australia, 2014). However it should be noted that Kien and Chiodo's interest in light intensity activity has not been widely embraced.

The Kien and Chiodo (2003) study draws attention to fundamental considerations in measuring physical activity from a Health Promotion perspective. This group measured program sessions without isolating the component parts of gardening and adventure games, confounding the understanding of garden physical activity but simultaneously recognising the importance of maintaining a holistic understanding of all program components when judging the net physical activity contribution of an initiative.

Furthermore, Kien and Chiodo measured habitual home activity in experienced program participants but conceptualised it as a control variable not an outcome variable, as others in this review will choose to do (Oosman et al., 2011; Wells et al., 2014). Kien and Chiodo's work demonstrates that the consequences of such assumptions and conceptualisations need to be considered in order to advance theoretical approaches for the discipline of Health Promotion.

3.1.2 Physical Activity Above 3 MET in a Mixed Activity After School Club

Domenghini (2011), Kansas State University, College of Agriculture, developed an after-school program for fourth and fifth grade students with a garden curriculum designed to promote physical activity. The sessions ran in Autumn Semester 2009 for 10 weeks and Spring Semester 2010 for 12 weeks, two afternoons per week from 3:30 until 5:00 PM. Accelerometers were used to determine the intensity of the physical activity of the children.

The sessions contained a maximum of 15 minutes gardening as the first 20-25 minutes consisted of an information session and snack time followed by students rotating around three stations – physical activities, gardening and a sessional topic – for 10-15 minute intervals. The children's mean age was around 10 years and female participants out-numbered males approximately 2:1 in autumn and 3:1 in spring.

Hip-borne accelerometers recorded physical activity during waking hours over six days from 26 and 18 students during Autumn and Spring Semesters respectively. Data collection days included two weekend days, two weekdays, and at least one Garden Club day. Fifteen-second epochs were used with the Freedson, Melanson, and Sirard (1998) equation. The percentage of time spent in each physical activity intensity level – sedentary, light, moderate, vigorous, and MVPA – was computed.

A methodological feature of this study was the classification of activity between 1.5 and 2.9 MET as Light and 3 and 6 MET as Moderate in keeping with the original Freedson et al. (1998) process. This 3 MET threshold was disputed in 2011 by Trost et al. (2011), just after Domenghini's work was completed.

Given Domenghini's particular definition of moderate activity, her study showed MVPA was significantly higher during Garden Club in both season semesters; Garden Club students averaged 29.4 minutes of MVPA in the Autumn and 26.3 minutes in the Spring as compared to 15 minutes on non-Garden Club days. As there was no non-Garden Club control for this study, there is no way of knowing if MVPA results simply mean the children were taking more physical activity during Garden Club, forcing them to accommodate their more sedentary responsibilities in the remainder of their weekly schedule.

Domenghini's work can be used to make the case for preserving a holistic comparative context of participants' daily lives outside a program. The case for compartmentalising program components is the continued inability to identify gardening physical activity from either study.

The next two pieces of work from Oosman (2011) and Wells, Myers and Henderson (2014) assess the impact on children's daily physical activity when a food gardening program is introduced to their school. Each uses a control group; one consisting of

age/sex matched children from the same school not receiving the intervention; the other using a waitlist control group.

3.1.3 Gardening in a Mixed Activity Program for Active Metis Children

In her doctoral work, Oosman (2012) used accelerometery to assess the physical activity of a school food garden program designed for Metis children using a participatory action process. [1]

Thirty-eight children from Grades 3-5 participated in what is described as a Health Promoting School initiative. Sixteen children from one class participated in a multi-strategy intervention delivered over four months by their classroom teacher in association with parents and community elders. The intervention sessions were designed collaboratively, adapted from materials used previously in other places in programs with similar objectives. Gardening featured in a number of healthy eating and active living sessions and activities. Twenty-two age-matched children, selected from other classes at the same school, agreed to act as a 'Standard Care' control group and did not receive the intervention sessions.

Participants wore hip-borne accelerometers during waking hours. Epoch length was one minute and Oosman chose to use the cut point set proposed by Puyau et al. (2002) to establish minutes at intensity levels. The intensity categories in this study are not described in terms of MET because the Puyau group rejected the practice of assuming a 1 MET value of 3.5 mL O2/kg per minute in children. They claimed the resting metabolic rate of children was significantly higher than adults and that adult-referent MET values are not applicable to children. This means the intensity categories of these results cannot be compared to other works reviewed here.

Data were screened with a minimum wear time compliance of three days and one day producing results demonstrating a similar trend; the results were less decisive for the longer wear time period.

By presenting both analytical approaches, Oosman attempted to address the unknowable variation in the measurement of physical activity. For small sample groups it is difficult

[1] The Metis are a recognized indigenous people of Canada.

to assert that even three days' wear time is sufficient to represent habitual activity levels for that particular group, undertaking that particular program, in that particular school setting.

Methodologies such as the participant action approach taken by Oosman in this unique community are fundamental in settings Health Promotion but they necessarily involve small group sizes and cause difficulties with probabilistic assumptions. This study exemplifies the need for methodological development to redress the dependence on assumptions of generalizability in settings research.

From the one-day wear time analysis, post-intervention time in sedentary activity was longer and time in activity of any intensity was shorter for both control and intervention groups. Each of these changes, however, was only statistically significant in the control group. Oosman proposed the reason for this was the intervention was having a 'protective effect' against seasonal physical activity changes – that is, the weather. Other potential factors to explain such differences were not put forward, such as unpredictable, physiological development of the group (Troiano et al., 2008), fluctuations in their psycho-social state as they approach puberty, habituation to the measurement process or other developmental cofactors that may have produced the indifferent class effects. The garden program itself also may have had a social impact, altering school life and reducing physical activity of both intervention and control classes.

Rejecting the concept of universal program responses and embracing the community empowerment ethos of Health Promotion, as Oosman clearly has with her choice of Participant Action methodology, means that small group longitudinal assessment of children's physical activity will remain fraught with the validation issues of objective measurement. Oosman's study demonstrates the necessity of supplementary sources of evidence, that is, mixed methods methodology in concert with participant action approaches.

While the simplicity of an objective outcome measure is appealing, Oosman's study has demonstrated that the issues of small group size, validation, generalizability and adequate contextualisation need to be addressed for Health Promotion purposes. In turn,

these higher methodological issues are significant in any attempt to advance Health Promotion theory (McQueen et al., 2007).

3.1.4 Accelerometery in a Randomised Control Trial of School Gardening

Wells et al. (2014) conducted a randomised control trial measuring the potential for the establishment of a school food garden program to increase physical activity and reduce sedentary inactivity in children during the school day. The multi-site program was conducted in newly establishing gardens in 21 classes Grades 4–5 (8–12 years) at 12 primary schools "in need" in New York State, USA. The program was a series of 20 lessons integrated into the academic curriculum, focussing on nutrition, horticulture and plant science. The program included what were described as 'additional activities' in the garden where the children learnt how to plant, weed and harvest. School participation was by invitation and a sub-set of schools was randomly allocated a delayed start, acting as a waitlist control group.

Data were collected on four occasions, with one pre-test and three post-tests conducted across a 12 month period. The children wore hip-borne accelerometers during the school day for three days. Accelerometery data were not collected from all participating children. Approximately 21 children (range per school 15–25) from a single class at eight of the 12 schools were chosen for data collection (method of selection not given). Data were collected in 30 second epochs, converted into counts per minute and further reduced to intensity categories using the 4 MET threshold for moderate intensity cut-point set for children from Evenson et al. (2008) - as recommended by Trost et al. (2011). The proportion of time spent at each physical activity intensity level was calculated for sedentary, light, moderate, vigorous and MVPA intensity levels for the school day-segment.

The statistical analysis was modelled to identify differences between intervention and control conditions at the school and student levels taking into account demographic factors and the variance in physical education (PE) and break time in the individual school schedules. Results showed increased time in moderate and MVPA intensity activity in the intervention group as compared to the control group but no change in the time spent in sedentary, light or vigorous intensity activity.

The actual changes in duration of moderate intensity activity were an extra 18 seconds per hour more than before the garden program.[2] The outcome was similar in MVPA where the controls had an insignificant increase of 24 seconds per hour, the intervention group a significant increase of 60 seconds per hour meaning an extra 36 seconds of MVPA per hour. These results reflect extra physical activity in the garden group in total, not just in the garden.

A simple challenge of this finding is how many minutes per hour of MVPA should be considered laudable and sufficient to warrant program sponsorship for its effect on physical activity. However, more fundamental issues concern bounding and advancing the discipline of Health Promotion. Approaches, such as Wells et al. (2014) used in their study, have a limited place in Health Promotion where methodology needs to reflect the ethic and purpose of Health Promotion.

To achieve Health Promotion ends, this study, and others like it, would need to form part of a broader mixed methods approach. For example, consider if the garden beds in one of the schools of this study had been established in an area previously used by a subgroup of children for their regular daily game of knee volleyball. Net MVPA minutes for school day-segments for these food garden participants and their class group might be unchanged but the garden has reduced the volume of physical activity for the individuals of the knee volleyball subgroup. Further, if that volleyball subgroup were socially excluded for some reason, that space may have offered them the opportunity to interact with others in a way that promoted social standing. These are the considerations of a Health Promotion perspective.

A Health Promotion perspective considers the intended and unintended consequences of change in land use in the playground from the broader understanding of health reflecting the public health principles. A Health Promotion professional taking a settings approach does not read significant increases of intensity seconds per hour and immediately see success. They look at the description of the implementation, the descriptive statistics of the objective measures, the experience of the participants and then start to ask questions about whether the program reduces gaps and inequalities and represents a social investment in increased physical activity and better health.

[2] No cost benefit analysis was provided in the published account.

3.1.5 Conclusion

These four studies shared a common interest in gardening as a means to promoting children's physical activity. The child participants were from diverse populations. The studies shared accelerometery as an objective method; however, decisions within the method led to different measurement procedures being applied.

The review found mixed activity programs which included gardening had higher measured physical activity than watching a video (Kien & Chiodo, 2003), performing habitual activity at home (Kien & Chiodo, 2003), school activity (Domenghini, 2011; Wells et al., 2014) and participation in after school care (Oosman et al., 2011). The methods used in these studies were inconsistent and there remains a need for descriptive analysis of accelerometer data in the context of the school food garden session.

They demonstrated the importance of conceptualisation, good study design, recognition of the social context of the program setting, inclusion of all program components in evaluation and the need to remain vigilant for unintended consequences of the program. In some cases this was through not being well controlled, unknown or biased subject selection, evident financial and service-access interests, and poorly conceived choice of control group or activity.

The critique of these studies as a collection has afforded the opportunity to contemplate results, but more importantly, the effect of choices within methods to reveal underlying assumptions of methodology and paradigm.

3.2 School Food Garden Physical Activity Measured by Accelerometer

This section reports a series of analyses of accelerometery data from two schools of this case study. It describes the physical activity of children participating in a series of school food gardening program sessions before investigating the impact of different choices within the accelerometery method. It examines variability in garden session physical activity between schools and across day-segments within a school, identifying the physical activity of the combined kitchen and garden sessions of the school food garden program. Finally it produces an empirical case for mixed method methodology in Health Promotion and identifies three potentials for school food gardens to increase physical activity.

3.2.1 Introduction

Accelerometers give objective measures used to quantify physical activity, and have been used for over a decade in field studies of school-aged children (Esliger et al., 2005; Freedson et al., 2005). They count oscillations in the mechanism caused by acceleration in the vertical axis to estimate volume of physical activity; the rate of counted oscillations estimates the intensity (Trost et al., 2005). Cut points are rate thresholds that delineate intensity categories and, according to a proprietary equipment supplier (Actigraph, Pensacola, FL), approximately 11 sets of cut points have been published for use in studies of school-aged children. The impact of different choices within the accelerometery method will be investigated before a rationale is stated and the final choice determined.

Cut points may be expressed as counts per minute but the sample duration -- the so-called epoch -- used for data sampling and processing is also a critical procedural choice and commonly ranges from one second to one minute. The epochs used in studies of children's physical activity tend towards shorter durations based on the belief that children act in bursts of activity characteristically short in duration (Trost et al., 2011). While the limitations of accelerometers are well-documented (Bornstein et al., 2011), choosing published cut points and a judicious procedure for analysis are believed to enable valid comparisons by volume and intensity (Lubans et al., 2011; Trost et al., 2005).

3.2.2 Aim

The aim of this series of analyses is to identify opportunities to increase physical activity in school food gardens and establish an empirical foundation to argue for continued method and methodological development in Health Promotion. The first analysis describes the volume and intensity of physical activity of three garden sessions at School One. The second identifies differences between Schools 1 and 2 in garden session physical activity relative to their non-gardening school days. The third and final analysis refocuses on School One, comparing physical activity in the garden session to segments of the school day-whole day, break-time, classroom and kitchen sessions.

3.2.3 Method

Actigraph (Pensacola, FL), Model GT3x+ accelerometers were used to measure the child gardeners' physical activity. The accelerometers were worn at the hip in line with the anterior axillary line on elasticised belts placed on the outer layer of school clothing. Actigraph Software Version 6.9.1 initialised accelerometers for collection with a 10 second sampling epoch (Trost et al., 2005).

Consenting children wore accelerometers during school hours (9am—3pm) for five consecutive days (one of which included Session One in the food garden), two additional garden sessions and, at School One, a kitchen session conducted on a day immediately subsequent to the consecutive wear. Garden and kitchen sessions were those of the regular class schedule.

A summary of the analyses conducted is presented in Table 3.1.

Table 3.1 Summary of accelerometery analyses performed in case study

	Comparison Situation	Number of Participants	Analyses
Analysis 1	Series of three garden sessions	16-22 Whole Group 12 Core Group at School One	Descriptive values for sessions t-Test comparisons sessions
Analysis 2	Whole school day compared to garden session	15 at School One 23 at School Two Inclusion minimum of three days' of continuous wear	Descriptive values for school day t-Test comparisons sessions
Analysis 3	School day-segments: whole school day, break time (morning break & lunch), total classroom (whole school day less break time) mid-morning classroom segments (between morning and lunch breaks).	15 at School One Inclusion minimum of two garden sessions and three non-gardening school days	Descriptive Mean values day-segments t-Tests
Analysis 4	Garden, Kitchen and Combined Program sessions	13 at School One Inclusion minimum of three days' wear time on non-kitchen, non-garden session days, plus kitchen and garden session one attendance. Combined Program data compiled by pooling raw data of kitchen and garden sessions.	Descriptive Mean values garden, kitchen and combined sessions t-Test comparisons

The first analysis uses data from the series of three garden sessions at School One. The group size varied between garden sessions: 22 child gardeners were present and assenting at Session One and 16 at each of Session Two and Three. A Core Group of 12 child gardeners was present and assenting across all three garden sessions, coincidently six boys and six girls.

The second analysis uses data from School One and School Two to compare results from their days of continuous wear to the garden session within it. Session One occurred on the third day of continuous wear and this day was excluded from those considered for the three days of wear time required for inclusion in the second analysis. A group of 15 children met the criteria at School One and 23 at School Two. Mean values were computed to create a single data point for each child for the whole school day segment.

The third analysis uses data from School One to perform a follow up of their specific setting. Data were subject to time filters based on the school bell times to create four day-segments of interest: whole school day (9.05 a.m.—2.50 p.m.), break time (combined morning and lunch breaks), total classroom (whole school day less break time) and mid-morning classroom segments (between morning and lunch breaks). The mid-morning segment corresponds with the timetabling of both garden and kitchen sessions. The third analysis has inclusion criteria of two garden sessions and three non-gardening school days and a group size of 15. The fourth analysis, a follow up that addresses the Kitchen day segment and Combined Program sessions, has inclusion criteria of three days' wear time on non-kitchen, non-garden session days, plus kitchen and garden session (Session One) attendance. The group size was 13. Values for Combined Program physical activity were compiled by pooling the raw data of the kitchen session and garden Session One.

The kitchen session occurred on the day after the continuous wear time week. For garden Session One the children had been wearing their accelerometers for the entire school day. For garden Sessions Two and Three and the kitchen session, accelerometers were distributed and collected at the meal breaks before and after the session. Local weather on data collection days was dry, warm, and sunny with temperatures within average seasonal ranges.

The garden and kitchen sessions were video recorded for later observational analysis. Time synched video images established the start and finish times of sessions, commencing with the garden or kitchen specialist's briefing to the class. Regular garden sessions lasted 45-60 minutes each week. The kitchen session lasted 98 minutes from 11:36am to 1:14 pm running into the first 14 minutes of lunch break.

Results were computed for volume and intensity of physical activity. The total volume was expressed as counts per person per minute (CPM) to permit the comparison of mean group values between sessions of different duration and group size. In the absence of a clear rubric to steer choice of procedures (Bornstein et al., 2011), it was decided to calculate intensity using different published cut point sets. Sets offered as options on the Actigraph proprietary software were considered. Sets were chosen for their development in age appropriate groups and related active living activities (Table 3.2).

Table 3.2 Intensity thresholds (CPM) described by Actigraph (Pensacola, FL)

Intensity Level Thresholds CPM	Light	Moderate	Vigorous	Very Vigorous
Evenson Children (2008)	101	2296	4012	
Freedson Children (2005)	150	500	4000	7600
Trost (2011) MET thresholds	100	2220	4136	
Puyau Children (2002)	800	3200	8200	
Mattocks Children (2007)	101	3581	6130	
Troiano (2008) Age = 9	100	1770	4360	
Age = 10	100	1910	4588	
Age = 11	100	2059	4832	
Age = 12	100	2220	5094	

All cut point sets were applied to the data in a visual exploration, recommended for all datasets before numerical analysis (Kuzma & Bohnenblust, 2001). Figure 3.1 presents the percentage of garden session time at School One in each of the intensity classifications for six cut point sets and illustrates the impact of this choice within the method on classification of garden physical activity intensity.

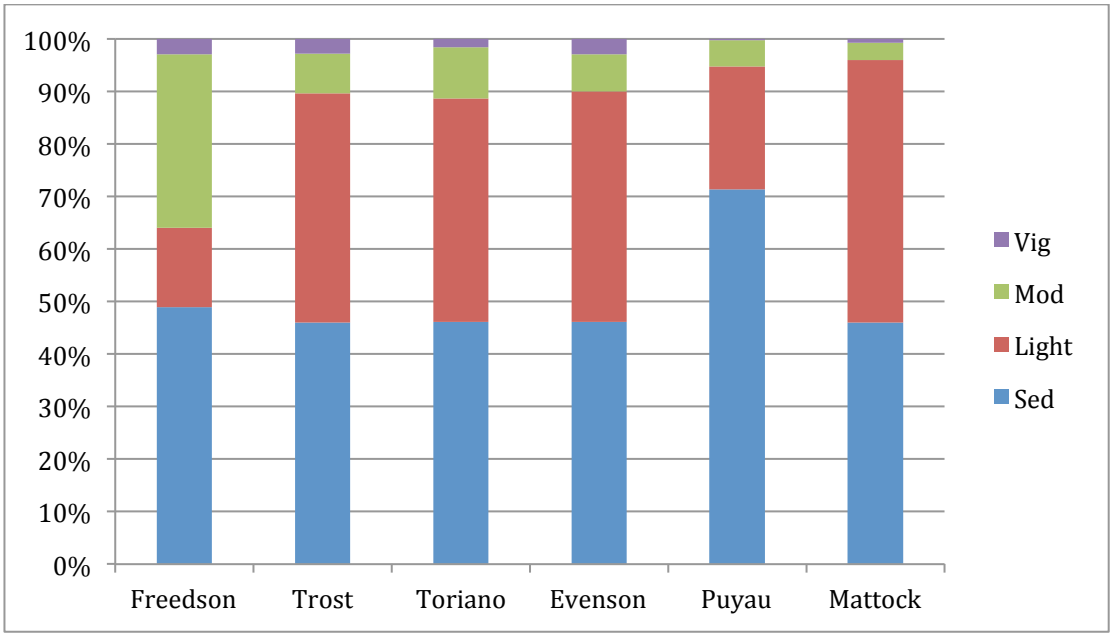


Figure 3.1 Percentage of Garden Session Time by Intensity for Six Cut Point Threshold Sets from Actigraph Proprietary Software (Series Mean, School One, Core Group)

Similarly, exploratory analyses were conducted changing the analysis epoch length from the sample epoch duration of 10 seconds out to the 60 second epoch recommended by Esliger, Copeland, Barnes, and Tremblay (2005). These epoch explorations changed the numerical results but did little to change trend impressions of the data. While these visual scoping investigations demonstrated the influence of choices within the method, a decision was needed which would allow achievement of the objectives of this case study.

The decision was to use both Freedson (FR) (Freedson et al., 2005) and Trost (TR) (Trost et al., 2011) cut point sets to focus on the choice of threshold discerning light from moderate intensity. The FR and TR sets arise from the same regression formula first published in 1997 (Freedson et al., 1997). These two sets differ in that moderate intensity physical activity commences at three metabolic equivalents (MET) in the FR definition and four MET for the TR set. Vigorous intensity physical activity commences at six MET in TR and FR definitions however the FR definition also include a very vigorous physical activity category commencing at nine MET.

Counts in the vertical axis per epoch for each student were exported into Microsoft Excel workbooks for analysis. Cut point ranges were applied from the TR and FR sets

to identify the intensity categories of each epoch – sedentary, light, moderate and vigorous intensity physical activity. Results for the FR very vigorous category were inconsequential (a series mean of less than two epochs) and subsequently incorporated with the vigorous category for analysis. A fifth calculated category, termed MVPA (moderate and vigorous physical activity), was created by adding the moderate and vigorous categories together. A sixth category, termed 3-4 MET, was created by subtracting non-MVPA counts of the FR set from non-MVPA counts of the TR set.

Three measures were analysed: 1) volume of physical activity; 2) time at each level of intensity; and 3) counts at each level of intensity. Time at intensity was expressed in minutes per hour and as a per cent for each level of intensity. Counts at intensity were expressed in per cent of counts per hour for each level of intensity. Whole group and subgroup values were calculated.

Descriptive statistics (means and standard deviations) were calculated for volume of physical activity in Whole Group, Gender Subgroups and Core Group for each session in the counts per person per minute (CPM). A repeated measures ANOVA was used to test the effect of session on volume of physical activity (CPM). Repeated measures t-tests were used to test for Gender Subgroup differences in volume of physical activity (CPM) in the sessions. These were undertaken in customised Excel spread sheets.

3.2.4 Results

Analysis 1

Physical activity of a series of three food garden sessions at School One

Group size and session duration varied for each session across the series; from a consented group of 24 students, group sizes were 22, 16 and 16 for the series. Twelve students constituted the Core Group present at all three sessions.

Table 3.3 shows the Whole Group mean ranged between means of 614 and 977 CPM for the three garden sessions giving a series mean of 759± 425.5 CPM. The Core Group mean ranged between 573 and 1064 CPM giving a series mean of 777± 420.0 CPM. Repeated measures ANOVA for the whole group showed the effect of session on CPM

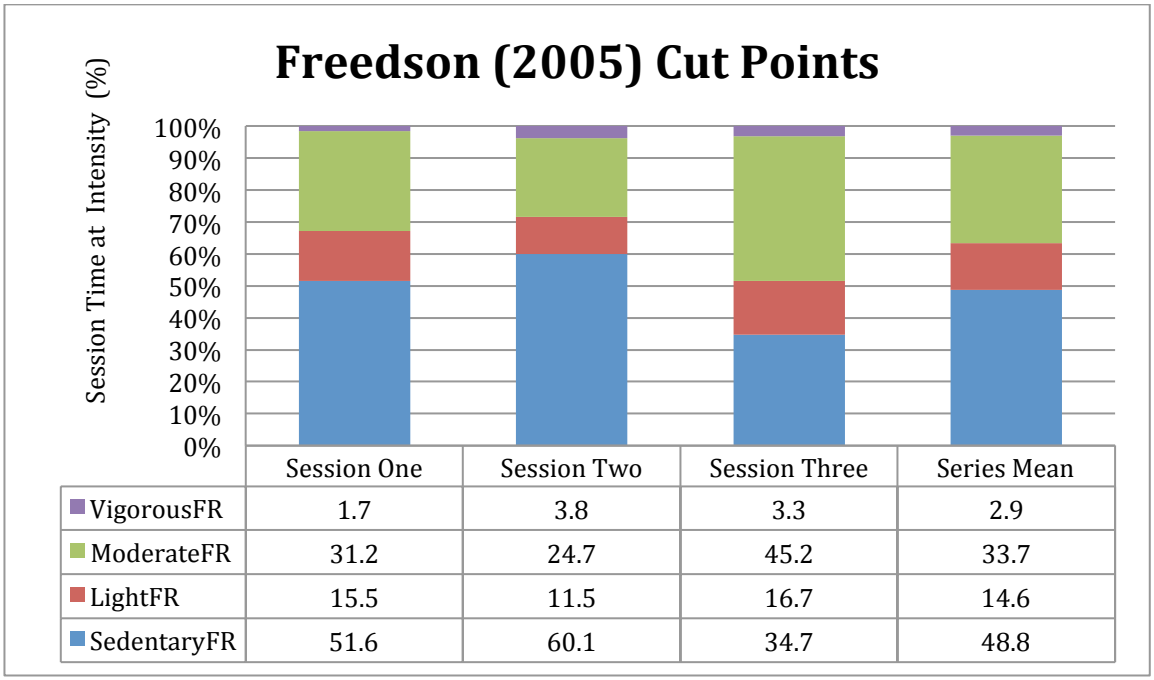
was significant, F (2,22)= 3.39, p=0.0457. Two tailed t tests showed no gender differences within sessions (p>0.18) in this class group.

Table 3.3 Volume of physical activity in school food garden session series (CPM)

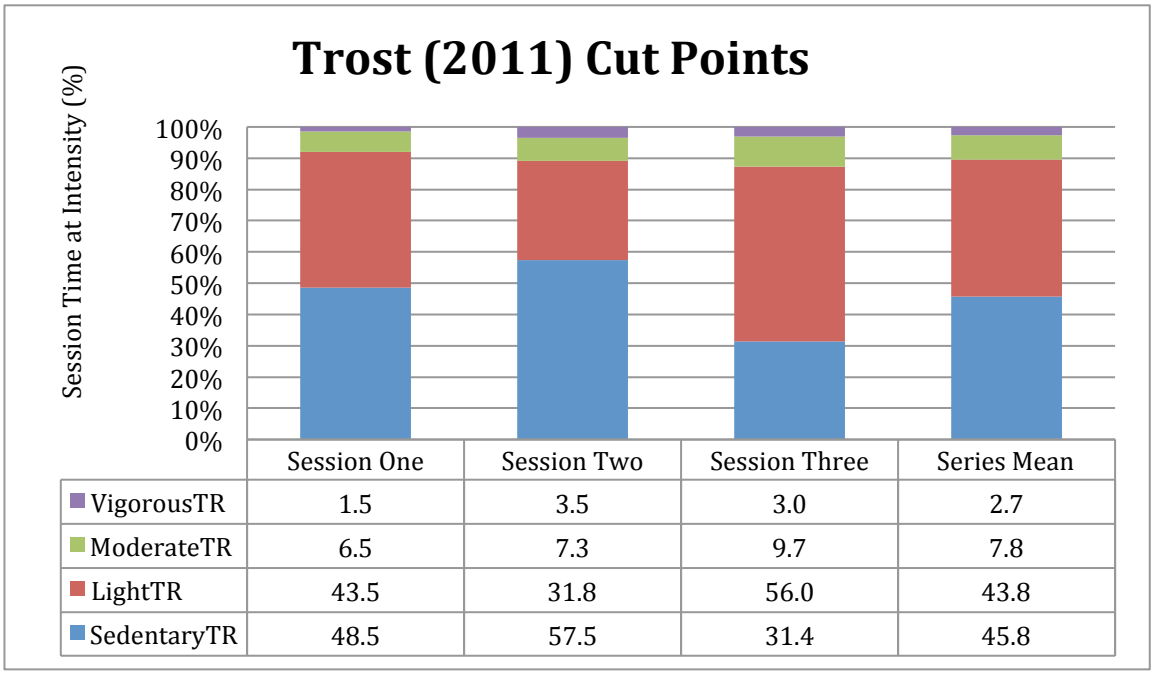
School 1	Session One	Session Two	Session Three
Group or subgroup	$\bar{x} \pm$ sd	$\bar{x} \pm$ sd	$\bar{x} \pm$ sd
Whole Group	614 + 293.0 n=22	687 + 652.9 n=16	977 +330.5 n=16
Girls Only	587 + 306.2 n=13	461 + 295.2 n=9	979 + 408.0 n=8
Boys Only	654 + 285.8 n=9	976 + 880.7 n=7	976 + 288.4 n=8
Core Group	573 + 274.4 n=12	695 + 684.1 n=12	1064 + 301.6 n=12
Duration	62 minutes	42 minutes	42 minutes

On the following page Figure 3.2 illustrates time at intensity (%) for the Core Group for the individual sessions and series mean described by both the FR and TR cut point sets. The individual sessions show variation across the series in sedentary, light, moderate and vigorous intensity levels.

The TR cut point set, defining moderate intensity at 4 MET, estimates each hour of school food gardening in this series resulted in 45.8% or 27.5 minutes of sedentary behaviour, 43.8% or 26.3 minutes of light activity, and 10.5% or 6.3 minutes of MVPA. By contrast, the FR set, defining moderate intensity at 3 MET, estimated each hour of school food gardening in this series resulted in 48.8% or 29.3 minutes of sedentary behaviour, 14.6% or 8.8 minutes of light activity and 36.6% or 22 minutes of MVPA. The 3-4 MET category in these school food garden classes for the core group is 26.2% or 15.7 minutes per hour, meaning approximately a quarter of the session activity occurs in the 3-4 MET range.



	Session One	Session Two	Session Three	Series Mean
VigorousFR	1.7	3.8	3.3	2.9
ModerateFR	31.2	24.7	45.2	33.7
LightFR	15.5	11.5	16.7	14.6
SedentaryFR	51.6	60.1	34.7	48.8



	Session One	Session Two	Session Three	Series Mean
VigorousTR	1.5	3.5	3.0	2.7
ModerateTR	6.5	7.3	9.7	7.8
LightTR	43.5	31.8	56.0	43.8
SedentaryTR	48.5	57.5	31.4	45.8

Figure 3.2 Time at each intensity level (%) of core group using Trost and Freedson cut points

Below Figure 3.3 illustrates data from Session One displayed in time series form showing the number of children active in each epoch by intensity category over the session. Results from the FR and TR sets are presented as separate graphics. The graphics are divided into their respective representations of MVPA showing the number of children achieving MVPA above the zero line.

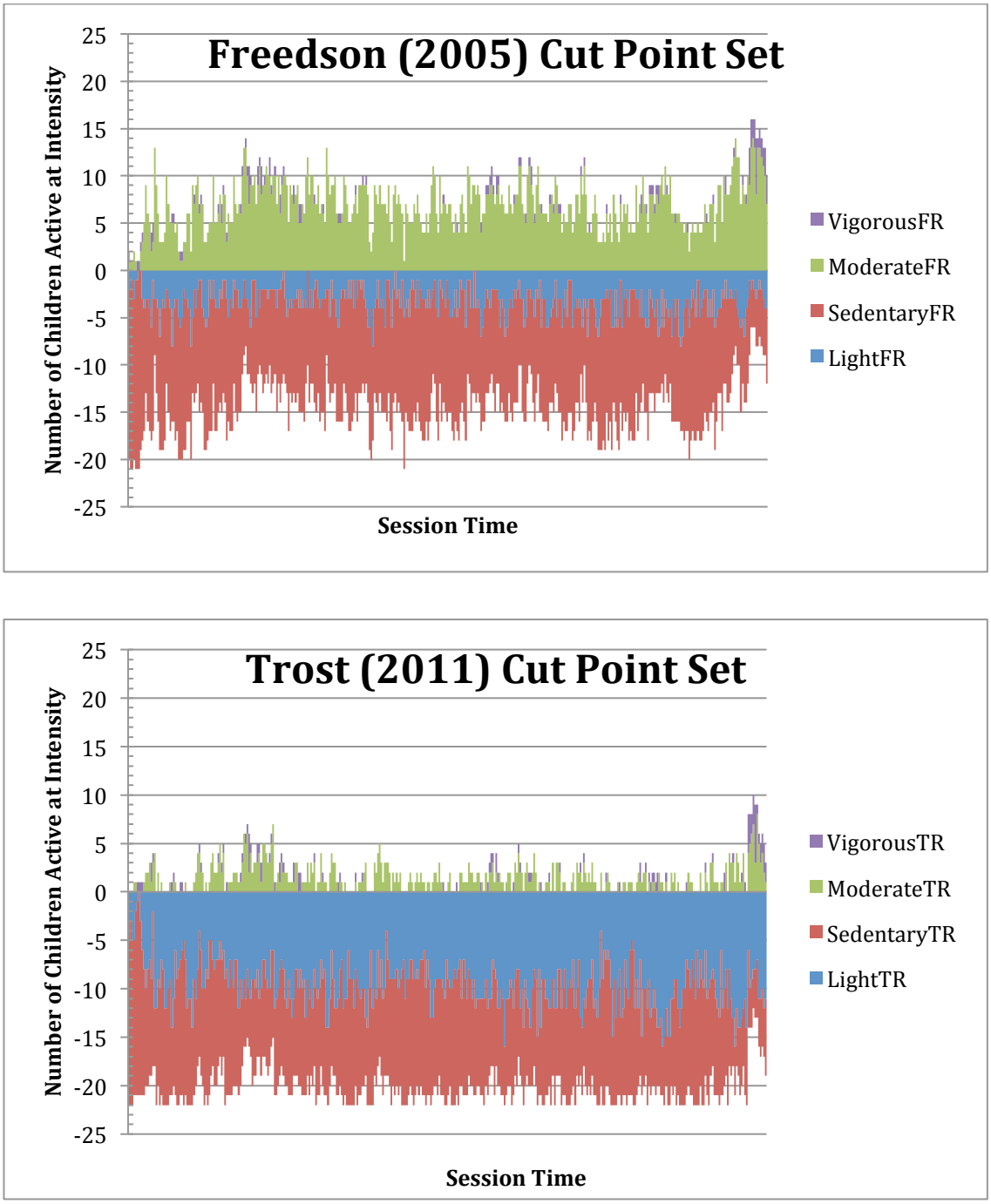


Figure 3.3 Time series plots showing the number of children engaged in sedentary, light, moderate and vigorous intensity physical activity in each epoch of Session One.

Table 3.4 represents counts at intensity (%) of sedentary, light and MVPA intensities. Applying the TR cut point set to data for the Core Group, non-MVPA activity contributes 47.1% of the volume of counts in this series but less than 10% in the series or any session using the FR set.

Table 3.4 Percentage of counts by intensity category (10 second epoch)

School 1 Core Group	Session One			Session Two			Session Three			Series Total		
% Counts	Sedentary	Light	MVPA	Sedentary	Light	MVPA	Sedentary	Light	MVPA	Sedentary	Light	MVPA
Freedson (2005)	0.9	54.2	44.9	0.7	36.2	63.1	0.4	48.8	50.8	0.7	46.4	52.9
Trost (2011)	1.5	8.2	90.2	1.1	5.0	93.8	0.8	5.3	93.9	1.2	6.4	92.4

Analysis 2

Physical activity of school food gardening sessions at Schools 1 and 2 relative to whole school day-segments

Tables 3.5 and 3.6 show the school day physical activity for School One and School Two. For the whole school day-segment, the children at School One returned 673.9 ± 184.3 CPM as compared to the 442.6 ± 134.3 CPM at School Two, a significantly lower value ($p<0.05$). The difference in garden session physical activity was even more pronounced. At School One the children returned 526.9 ± 300.16 CPM and at School Two 188.3 ± 79.1 CPM, a mean CPM just over a third of School One, another significant difference ($p<0.05$).

For School One, there was no significant difference ($p>0.05$) for the total physical activity or any of the intensity categories between garden session and whole school day-segment. The data show less physical activity per hour during the garden sessions than during the whole school day-segment but not significantly so.

For School Two, the total volume is significantly less during the garden session than the regular school day ($p<0.05$). Significantly less MVPA ($p<0.05$) was recorded per hour in the garden session than during the regular school day at School Two.

Table 3.5 School day approach for School One

3 Day Wear 2 Session Series	Whole School Day (n=15) 673.9 ± 184.3* CPM			Garden Session 526.9 ± 300.16* CPM		
	Mins/hr (%)			Mins/hr (%)		
Cut point source	Sedentary	Light	MVPA	Sedentary	Light	MVPA
Freedson (2005)	37.3 62.2 %	6.7* 11.2 %	15.9 26.5 %	34.0 56.7 %	9.1 15.2 %	16.9 28.1 %
Calculated			3-4 MET 9.8* 16.4 %			3-4 MET 12.7 21.2 %
Trost (2011)	35.6 59.4 %	18.5 30.8 %	5.9* 9.9 %	32.1 53.5 %	23.6 39.4 %	4.2 7.0 %

* significant at $p<0.05$

Table 3.6 School day approach for School Two

3 Day Wear 2 Session Series	Whole School Day (n=23) 442.6 ± 134.3 CPM ($\bar{x} \pm sd$)			Garden Session 188.3 ± 79.1 CPM ($\bar{x} \pm sd$)		
	Mins/hr (%)			Mins/hr (%)		
Cut point source	Sedentary	Light	MVPA	Sedentary	Light	MVPA
Freedson (2005)	43.5 72.5 %	5.0 8.4 %	11.5 19.1 %	48.4 80.7 %	5.8 9.6 %	5.8 9.7 %
Calculated			3-4 MET 7.0 11.7 %			3-4 MET 4.6 7.6 %
Trost (2011)	42.0 70.1 %	13.5 22.5 %	4.5 7.4 %	46.5 77.4 %	12.3 20.5 %	1.2 2.1 %

* significant at $p<0.05$

Analysis 3

Physical activity of day-segments at School One to compare garden sessions to whole school day, school break, total classroom and mid-morning day-segments

Table 3.7 reports results for whole school day, school break, total classroom and mid-morning day-segments for the third analysis. The garden series ($p<0.05$) had significantly higher mean volume of physical activity (CPM) than total classroom and mid-morning sessions and significantly lower mean volume of physical activity (CPM) than break time ($p<0.05$). There was no difference in mean volume of physical activity (CPM) between garden sessions and whole day-segments ($p=0.50$).

Using the 3 MET threshold of the FR cut point set, garden series was not significantly different to whole school day for time in MVPA ($p=0.44$), had significantly more time in MVPA than both classroom time or mid-morning class ($p<0.05$) and significantly less time in MVPA than in break time ($p<0.05$). For the 4 MET threshold of the TR cut point set, garden series was not significantly different to the mid-morning class time for time in MVPA ($p=0.16$), had significantly more time in MVPA than classroom time ($p<0.05$) and significantly less time in MVPA than both break time ($p<0.05$) and whole school day ($p=0.02$).

There were no significant differences in time in the 3-4 MET range when comparing the garden series to school breaks ($p=0.49$), however all other day-segments had significantly less time in the 3-4 MET range ($p<0.05$).

For Light activity as measured by the FR cut point set, there was no difference between the garden and break time segment ($p=0.07$) and there was significantly less light activity in the class room, mid-morning and whole school segments ($p<0.05$). When measured by the TR cut point set, the results followed the same pattern with a more decisive p-value for school breaks segment ($p=0.23$).

There was no significant difference between day-segments in sedentary intensity ($p>0.05$).

Table 3.7 School day segment approach for School One

3 Day Wear 2 Session Series	Whole School Day 673.9 ± 184.3* CPM ($\bar{x} \pm$ **sd**)			School Breaks 1318.8 ± 435.5* CPM ($\bar{x} \pm$ **sd**)			All Classroom Session 467.1 ± 125.9* CPM ($\bar{x} \pm$ **sd**)		
	Mins/hr (%)			Mins/hr (%)			Mins/hr (%)		
Cut point	Sedentar	Light	MVPA	Sedentar	Light	MVPA	Sedentar	Light	MVPA
Freedson (2005)	37.3 62.2 %	6.7* 11.2 %	15.9 26.5 %	22.1 36.8 %	7.7 12.9 %	30.2* 50.3 %	42.2 70.4 %	6.4* 10.7 %	11.3* 18.9 %
Calculated			3-4 MET 9.8* 16.4 %			3-4 MET 16.1 26.9 %			3-4 MET 7.9* 13.1 %
Trost (2011)	35.6 59.4 %	18.5	5.9* 9.9 %	20.4 34.0 %	25.9	13.7*	40.5 67.5 %	16.1	3.4* 5.7 %

3 Day Wear 2 Session Series	Equivalent Classroom 459.5 ± 188.2* CPM ($\bar{x} \pm$ **sd**)			Garden Series 687.6 ± 177.0 CPM ($\bar{x} \pm$ **sd**)		
	Mins/hr (%)			Mins/hr (%)		
Cut point source	Sedentary	Light	MVPA	Sedentary	Light	MVPA
Freedson (2005)	39.4 65.6 %	7.5* 12.5 %	13.1* 21.9 %	30.3 50.5 %	8.8 14.7 %	20.9 34.8 %
Calculated			3-4 MET 9.4* 15.7 %			3-4 MET 15.6 26.0 %
Trost (2011)	37.6 62.6 %	18.8 31.3 %	3.7 6.1 %	28.4 47.4 %	26.2 43.7 %	5.3 8.9 %

Significant at ($p<0.05$

Analysis 4

Physical activity of a Combined Program day-segment from a school food garden program compared to its constituent garden and kitchen sessions

Table 3.8 reports results for the Combined Program and its constituent garden and kitchen day-segments for the final analysis. In the week of testing the Kitchen session ran for 98 minutes, the garden session 62 minutes making the Combined Program 160 minutes in duration. Total volume of physical activity (CPM) was 557 ± 287.6 CPM for the garden session, significantly greater ($p<0.05$) than 278 ± 116.1 CPM for the Kitchen segment and 393 ± 129.0 CPM for the Combined Program. In the kitchen, 71% of time was in the sedentary intensity level.

There was significantly more time at sedentary intensity in the Kitchen and Combined Program segments ($p<0.01$) than the garden segment. There was significantly less MVPA in the Kitchen and Combined Program segments ($p<0.01$) using either cut point set. There was significantly more 3-4 MET activity ($p<0.02$) in the garden session. There was no significant difference between garden session and combined program time for light intensity using the FR cut point set ($p=0.18$). There was significantly less light intensity using the TR cut point set in the Kitchen segments ($p<0.01$).

Table 3.8 Kitchen garden and combined components of the program

3 Day Wear & Kitchen Session (n=13)	Garden Component (Session One) 557.0 ± 287.6 CPM			Kitchen Component 277.7 ± 116.1* CPM			Combined Components 392.7 ± 129.1* CPM		
	Mins/hr (%)			Mins/hr (%)			Mins/hr (%)		
Cut point source	Sedentary	Light	MVPA	Sedentary	Light	MVPA	Sedentary	Light	MVPA
Freedson (2005)	33.3 min/hr 55.0 %	9.0 min/hr 15.0 %	17.7 min/hr 29.0 %	42.6* 71.0 %	7.5* 13.0 %	9.9* 16.0 %	38.7* min/hr 65.0 %	8.2 min/hr 14.0 %	13.1* min/hr 22.0 %
			3-4 MET 13.2 min/hr* 22.2 %			3-4 MET 8.3* 13.9 %			3-4 MET 10.4* min/hr 17.3 %
Trost (2011)	31.5 min/hr 52.5 %	24.0 min/hr 40.1 %	4.5 min/hr 7.5 %	40.5* 67.5 %	18.0* 30.0 %	1.5* 2.5 %	36.8* min/hr 61.3 %	20.5* min/hr 34.1 %	2.7* min/hr 4.5 %

* Significant at $p<0.05$

3.2.5 Discussion

This study confirms school food gardens are a site of physical activity. They contribute to the volume of school day physical activity and demonstrate a contribution of at least moderate intensity physical activity using either three or four MET thresholds. Variability is observed between sessions and locations. Choices in the method have a demonstrable impact on our understanding of physical activity. These necessitate the further conceptual development of physical activity from a Health Promotion perspective. Three potentials to increase physical activity are identified. Each of these findings is discussed in turn.

Volume and Variability of Physical Activity at Case Study Schools

The volume of physical activity measured in the case study schools is comparable to those of other published reports describing whole school day segments for primary school-aged children from hip borne Actigraph accelerometers. In this case study, School One returned a mean volume of 673.9 CPM and School Two a mean volume of 442.6 CPM. These compare to volumes reported by Brockman, Jago and Fox (2010) that showed a mean weekday volume of 545.4 CPM and an after-school mean volume of 678.2 CPM. Gidlow et al. (2008) report a mean volume of 510.7 ± 148.5 CPM during school hours. Riddoch et al. (2007) report a median volume of 579 CPM for weekday waking hours not limited to school hours. Disappointingly, comparative mean volumes have not been reported in school break studies (Ridgers, Fairclough, & Stratton, 2010; Ridgers et al., 2007). This oversight should be addressed in the future to fully appreciate the contribution of light intensity physical activity to energy expenditure and the health promoting opportunities of children's daily-life activity.

A high degree of between-session variability in total volume of physical activity is evident in the physical activity of the series of garden sessions at the case study schools. There is a significant effect from the sessions. Additionally, a high degree of variability is evident between schools, so much so that contradictory recommendations would need to be given to the schools if they were seeking to increase physical activity. At School One, the volume of physical activity per person per minute from the garden session was not significantly different to that from the regular school day during that week. For School Two, the mean volume of garden physical activity was less than half that from

the regular school day. This needs to be carefully considered to avoid the erroneous interpretation that the evidence of this study supports a conclusion that school food gardens currently promote increased physical activity.

The results of this study demonstrate that school food gardens have a potential to increase physical activity; they are an under-used spaces that might be the site of more physical activity given changes in attendance, programing and timetabling. Changes to the duration of the garden session would affect the volume of physical activity in each case study school to different extents and in different directions. At School 1, analysis 3 showed garden sessions had a significantly larger volume of physical activity as compared to classroom sessions ($p<0.05$) but a significantly smaller volume as compared to break time ($p<0.05$). Here, longer garden sessions could be expected to increase physical activity, provided they did not impinge on school breaks. At School 2, analysis 2 showed garden sessions had a significantly smaller volume of physical activity than whole school day activity ($p<0.05$) (incorporating both classroom and break time). There, a longer garden session could be expected to significantly decrease physical activity. Evidence-based recommendations must therefore be made in knowledge of the local program to ensure the effect is an increase in physical activity, not the reverse.

Choices within the Method

Choices in the method influence our understanding of garden physical activity and differentially valuing physical activity of any given intensity would have a further impact. The choice of cut point set in this study changed time at intensity values and the proportion of children thought to be engaged in sedentary or light activities in the garden. Children were engaged in physical activity above 4 MET for 6.3 minutes per hour (10.5% of the session) or 3 MET for 22 minutes per hour (33.6%). Despite this large difference and the widespread use of accelerometery to evaluate a significant children's health outcome, the rationale for changing the lower limit of moderate intensity (and therefore MVPA), does not appear to have received a conceptual challenge when adopted from the Behavioural Sciences.

Graphing intensity results as a time series demonstrated the combined influence of cut point choice and the practice of considering MVPA in isolation. Figure 3.3 showed a

small number of children engaged in MVPA at any time in garden Session One as described by the TR cut point set and more when described by the FR set. The volume of activity is no different; the lived experience of the children is identical. The difference in these two time series is the conceptualisation of physical activity worthy of professional purview. The issue is whether that conceptualisation and the professional purview are from a Health Promotion perspective or whether they are remnant from the methods origins in Behavioural Science.

Thus, by considering the volume of activity within each intensity category, a conceptual inconsistency with the holism of Health Promotion becomes apparent in the method. Approximately half the volume of counts recorded in the garden was achieved at a rate of less than 3 MET and a similarly important proportion accumulated in the 3-4 MET range. To consider only MVPA above a 4 MET threshold removes from consideration approximately 90% of the total volume of counts generated by the group. The irony is, that to accept a 4 MET definition of moderate activity invariably increases the importance of the contribution of light intensity activity, when the decision to value only MVPA then completely strips light intensity activity from making a contribution. Consequently, the vast majority of physical activity in a child's daily life at school, as observed in this study, can no longer be considered for its importance to health.

Further development is needed in the conceptual basis of physical activity from the Health Promotion perspective to align methods with Health Promotion's more holistic understanding of health from the activity of daily life.

Three Potentials to Increase Physical Activity

There is evidence of a potential for increased physical activity from school food gardening given certain caveats concerning attendance, timetabling and programming. Accelerometery, while a method demonstrably able to identify potentials for increased physical activity, is insufficient to identify the contextual information necessary to identify opportunities to realise those potentials. This observation forms the basis of the argument for use of mixed methods methodology to measure physical activity from a Health Promotion perspective. The limits of accelerometery as a stand alone method are discussed under each of the three potentials for increased physical activity identified in this study:

Attendance

Regular attendance is an important potential for increased physical activity from school food gardens. From an initial Whole Group of 22 child gardeners at School One, only 12 were present as a Core Group attending each session of the series of three. Attrition in participation may be related to out-of-program commitments (mandatory or by voluntary evasion) or school day attendance of the children. Absence from garden sessions may be a consequence of system factors such as funding conditions, curriculum requirements, staffing allocations, staff training or even garden program discipline practices. System factors of these kinds are present in all school settings, imposed by internal, external and governance bodies and are responsive to the social, political and policy actions Health Promotion commonly uses to address them (WHO, 2014). The case study provided an occasion to observe group sizes and the attendance of individuals in a series of garden sessions, however this is not an exclusive feature of the accelerometery method.

Timetabling

The volume of physical activity of the garden series was higher than classroom day segments, especially the mid-morning segment during which the garden sessions were regularly scheduled. There is less clarity when considering physical activity by intensity categories, as the understanding is reliant on the cut point threshold used and the criterion intensity category examined. Attendance in the garden series provided significantly more activity over 3 MET than the mid-morning class it replaced, but no difference existed between segments in physical activity over 4 MET. This reflects a lack of difference at sedentary intensities between segments, the high proportion of garden activity in the 3-4 MET range and the relatively few counts at higher MET.

Garden sessions demonstrated a significantly lower volume of physical activity than school breaks. Timetabling a garden program to avoid impinging on high activity break time could preserve or elevate the volume and intensity of school day physical activity, depending on the current timetabling practice. A related strategy, to timetable garden sessions in the segment of the school day with the lowest energy expenditure, is not widely practicable. Schools with multiple grades and classes involved in the garden

program will be restricted in their ability to optimise for all their students the timetabling of the garden session based on classroom physical activity.

Timetabling needs to be approached from a holistic consideration of strategies to improve children's health. Low activity in the classroom may indicate a time ideally suited to necessarily sedentary teaching sessions for high-focus academic subjects. Interrupting this teaching and learning may undermine the health promoting influence of a solid primary school education. Low activity may also indicate a ritual event in the school week such as Assembly, Student Senate or a current affairs television broadcast. Clearly, other methods are needed to establish the contextual information necessary to evaluate the opportunities to increase physical activity from changes to timetabling.

Programming

Programming offers a potential to increase physical activity through changes to the relative durations of kitchen and garden sessions in creating the combined School Food Garden program. The Kitchen session had almost exactly half the volume of physical activity of the garden session and had significantly less time at intensities when compared to either garden or combined program sessions. Only non-sedentary physical activity of less than 3 MET intensity was not significantly different ($p=0.18$) between garden session and combined program time. The impact of the Kitchen session on total physical activity of the Combined Program was exacerbated by the duration of the kitchen component that impinged on the very active lunch break period by 14 minutes.

Programming change disturbs. It should rate alongside other significant process achievements in school settings Health Promotion. While programming may afford a realisable opportunity, the effort involved in the process of change should not be underestimated. The nutrition education benefits of gardening programs are greater when children undertake both kitchen and garden components of a school food garden program (Morgan et al., 2010). So while changing the duration of session segments may positively impact school day physical activity, the judgement of whether there has been a positive impact on the program as a whole is determined by the program's original purpose. A longer garden session or kitchen session constrained to avoid break time should be assessed in the context of all the program's health objectives.

3.2.6 Conclusion

The series of analyses aimed to identify any potential to increase physical activity with school food gardens and establish an empirical foundation to argue for continued method and methodological development in Health Promotion. Local evidence-based recommendations are needed in the interests of increasing physical activity at each school site. A conceptual inconsistency was revealed by examining two choices within the accelerometery method, highlighting the need for further conceptual development of physical activity from a Health Promotion perspective. Potentials for increased physical activity from attendance, timetabling and programming were identified. A Mixed Methods methodology is recommended to provide contextualising information for accelerometery and create an understanding of opportunities to realise potentials.

3.3 Method and Methodological Development

The accelerometery study identified areas for further method and methodological consideration. Local reporting of physical activity volumes (CPM), calculating a comprehensive range of intensity categories from multiple thresholds and dispensing with the practice of reporting MVPA in isolation are factors that will improve description of garden physical activity by accelerometery methods. This final section returns to the published work of other physical activity researchers to understand more of the development needs of physical activity from a Health Promotion perspective.

3.3.1 Consider the Full Spectrum of Intensity

Pate (1995) stated that sufficient physical activity for health has two markers – volume of activity and intensity independent of volume. Guidelines and physical activity recommendations developed over the last 30 years, including those for children, have retained statements promoting diverse intensity activities. Yet all the while, focus has been shifting away from the practice of valuing light activity and instead venerating the recognition of MVPA (Lee & Shiroma, 2014). Even recent interest in decreasing excessive sedentary behaviour has done little to change this focus. This creates an expectation that sedentary time translates to MVPA without any way to represent what might happen to light activity in between.

The large percentage of counts in the 3-4 MET range demonstrated in the gardening sessions provides evidence that programs that have relatively few minutes of intensity over 4 MET may still be making important contributions to children's physical activity for health through volume increases. MVPA alone is a poor substitute for measuring the full spectrum of intensities marked alongside a measure of the total volume of activity, especially in activities of daily life.

3.3.2 Limits of a Probability Approach

Variability in the garden series data was in keeping with observations published in other studies of school day-segments (Fairclough, Butcher, & Stratton, 2007). This present study echoes the uncertainty that Fairclough, Butcher and Stratton (2007) express concerning the possibility of establishing generalizable values for school day-segments. Foley et al. (2011) questions school-segment measures based on the reactivity and the observation effect. The variability of session results is confounded by the impracticability of an extended series of weekly or fortnightly baseline recordings in children who are rapidly developing.

Much like Physical Education sessions, activity within garden session segments is regulated by pedagogical purpose and cannot be assumed to be entirely self-determined. Equally, the part of a session that is self-determined may well be delivering other health outcome benefits that are the unintended consequences of gardening programs (Dyment & Bell, 2008). It seems the assumptions and conditions of generalised probabilistic approaches to measuring physical activity may not be present in school setting circumstances.

The reality of small group numbers is another challenge to adopting a probabilistic methodological approach when investigating new and additional health objectives in established school setting initiatives. Established programs diversify from their initial implementation design. These two garden programs revealed significantly different results and realisable opportunities despite both having gardens of similar maturity, funded from similar start-up sources. Each school had been forced to evolve their program independently to ensure its sustainability. Given that short term establishment funding is the reality of most funding interventions, schools sustaining their programs through local efforts eventually develop distinctly different programs as a result of their

different access to resources. Even those from similar origins diversify sufficiently to warrant a meta-analytical approach. A Health Promotion approach, with its unique recognition of on-going setting development, the myriad of nuances in the creation of place and the fluidity of social health outcomes, makes probabilistic approaches untenable in evaluating mature programs.

3.3.3 Mixed Methods Methodology

The school descriptions presented in Chapter 2 might suggest possible causes for the difference in school day physical activity between School One and School Two. Biophysical, socio-economic and ecological influences on the schools and garden sites would undoubtedly reveal associations. Immutable biophysical factors, like weather, soil type and global positioning are not the concerns of Health Promotion. Accelerometery in isolation may identify differences but to understand the best course of change requires other sources of information on the garden program and each school.

Gardening is a physical activity with specific motivations. Efficiency and lowered energy expenditure in gardening activity are masterly objectives, inextricable from good gardening techniques (Bartholomew, 2005). Vigorous activity in combination with the use of tools which can cut, impale and maim are significant considerations for those with duty of care responsibilities. Thus physical activity in schools can be quite regulated (NSW Government Education, 2016). It is important to remember that these aspects of learned efficiency, social responsibility and behavioural mitigation will be present in the objective data and the physical activity of school food gardeners. Development of methods using accelerometers should also address the conceptual development of outcome measures relevant to activity of daily living programs. This development is another reason to recommend the widespread use of Mixed Methods methodology.

3.3.4 A Health Promotion Perspective

On-going debates to standardise accelerometery methods in order to allow a uniform approach to research and surveillance of physical activity volume and intensity need resolution (Bornstein et al., 2011). Discussion of standardizations should also proceed alongside methodological and paradigmatic debate. Accelerometery methods have

much to offer the discipline of Health Promotion, however their application needs to be drawn forward from a behavioural science paradigm (Lubans et al., 2011) and developed. Empowering communities is more in line with the interests of the discipline of Health Promotion. It would seem from the pledges of the Ottawa Charter that enabling school communities to collect and understand their physical activity information and determine locally their best course of action is preferable to methods, methodologies and theories that increase their reliance on expert control.

In such a participatory paradigm, using a settings approach, each school is a unique environment with issues common to other schools but addressed by local means (Buijs & Bowker, 2010). It is simply wrong to assume garden sessions are more active than classroom sessions without local evidence. Although Kien and Chiodo (2003) and Wells et al. (2014) have demonstrated increased activity from the introduction of a garden program, the data presented for either School One or 2 from this case study suggest this is not a universal experience. A participatory paradigm affords the opportunity to challenge and overturn probabilistic generalisations. Standardisation of accelerometer methods will not address the deeper development issues of measuring physical activity from a Health Promotion perspective.

For Health Promotion objectives, it is important that physical activity is evaluated by means that are discernible and meaningful to the children as they garden. Developing this salience and concordance is the basis for development of greater principles of subjectivity, participation and community empowerment, the underpinnings of the Health Promotion perspective (Frolich & Potvin, 2008). Thought is needed on how objective information from accelerometery can combine with other methods to communicate meaningful, accessible, comprehensible feedback to support the process of setting change.

Greater physical activity, evaluated by volume and intensity measures, does not represent successful Health Promotion ends in themselves. In the review of literature that opened this chapter, a hypothetical situation was posed to explore equity issues in playground access following introduction of a school garden initiative. Issues of this kind are undetectable by accelerometery used in isolation However, those issues are also unable to be estimated *without* an objective measure such as accelerometery. It is

also true that they are unable to be addressed while the promotion of physical activity for health is framed by volume and intensity alone. These issues are unable to be addressed until method and methodological developments are made to ensure the consideration of physical activity from a Health Promotion perspective.

There is a need to diversify methods of evaluating physical activity and open a conceptual discussion of physical activity from a Health Promotion perspective.

3.4 Chapter Summary and Conclusion

This chapter reviewed studies of physical activity in school food gardening programs as measured by accelerometery. The review found these studies were mixed activity programs and a need remained to describe the physical activity of garden sessions. An analysis of accelerometer data collected in two case study schools confirmed that school food gardens are a site for physical activity and that three potentials exist to realise increases in physical activity from the garden program. The method of accelerometery used in isolation is insufficient to confirm the health promoting value of realising these potentials. A conceptual discussion of physical activity from a Health Promotion perspective is indicated by an inconsistency recognised in the method whereby a significant volume of movement goes unrecognised because of assumptions about the relationship of intensity to health outcomes.

This descriptive study highlighted the importance of light intensity activity of 3-4 MET to total volume of physical activity, identified the variability between schools of garden sessions and compared garden sessions to the other school day segments they would replace. Three potentials for school food gardens to increase physical activity were identified: regular attendance; timetabling sessions to avoid high activity break times; and regulating the relative length of session duration for garden and kitchen components of the program. Each of these is a school system factor.

The practice of using isolated objective methods for Health Promotion research was drawn into question by conflicting local conclusions drawn at two case study schools. These were used to argue for development of methods and use of Mixed Method methodology in pursuit of the greater goal of developing theory appropriate for the unique purposes of Health Promotion research in the school setting.

4 VISIONING SCHOOL FOOD GARDEN PHYSICAL ACTIVITY

It has been established that school food gardens are a site for physical activity exhibiting attendance, timetabling and programming potentials. The premise to be tested in this chapter is whether school food gardens demonstrate realisable opportunities to fulfil these potentials for increased physical activity. The accelerometery method, applied in isolation in the previous chapter, was unable to investigate sufficiently whether the programs had the capacity to achieve change from the three potentials identified. In this present chapter a mixed methods approach is introduced. Two visual data studies were conducted that aimed to contextualise accelerometery potentials and establish how realisable opportunities to fulfil these potentials might be recognised.

The first study uses time-lapse photography to describe food garden use at times outside programmed garden sessions. The second study uses video imaging to support descriptive analysis of the food garden sessions at case study schools. A discussion of realisable opportunities to fulfil potentials to increase physical activity identifies seven conceptual elements of physical activity from a Health Promotion perspective. This chapter concludes with a proposal that the pledges of the Ottawa Charter are a suitable framework to judge the credibility of conceptual elements nominated as representative of a Health Promotion perspective.

4.1 Method, Methodology and Perspective

A Health Promotion perspective is fully expressed when it pervades the means and ends of an undertaking. The ends of Health Promotion are readily understood through familiarity with the actions and strategies and published preamble of the Ottawa Charter. However, exercising the means of Health Promotion, that is, in accordance with the perspective of Health Promotion, requires methods that demonstrate and enact broader Health Promotion ideals such as participation and empowerment (Frolich & Potvin, 2008). Few methods do this. Instead, they entrench privileged professional knowledge and program evaluation, purporting to serve Health Promotion ideals through the sage extrapolation of their findings (Oakley, 2005). This is a process that follows the letter but not the spirit of the Charter. In a schools setting, this is implementation – perhaps read imposition – of evidence-based initiatives in a limited

number of school communities that are fortunate to find themselves change-ready and change-able at a time when program funding is granted.

Developing concepts and methods that purport to be from a Health Promotion perspective requires certainty that an agreed perspective of Health Promotion is being honoured, not one that is simply expedient or purposive. The pledges of the Ottawa Charter, and the ethic they comprise, epitomise a Health Promotion perspective in that they have been instrumental in defining the discipline, remaining relevant for over 30 years (Alla, 2016; Breton, 2016; Potvin & Jones, 2011; Wise, 2008). The pledges are a series of principle couplets that might be implemented through method, methodological and theoretical development as the means of Health Promotion, just as they have effectively determined the professional development of its ends over the last 30 years (Hancock, 2011; Madsen, 2016).

Furthering conceptual development of a Health Promotion perspective of physical activity is important to the theoretical objectives of this work. Lewins (1993) asserts that the role of concepts is to cue researchers to identify evidence when they are in its presence. A conceptual framework is integral to method and methodology. McQueen et al. (2007) eloquently describe a progressive relationship between concept, method, methodology, theory and the emergence of a new discipline. These epistemological features are integral factors of the theoretical development process and it is not an accident that conceptual discussion arises in the analysis of a Mixed Methods case study aiming to advance Health Promotion theory.

So while the evident paucity of Health Promotion theory may be lamented (Nutbeam et al., 2010), its cause may be rooted in a less evident lack of Health Promotion conceptualisation of health outcomes, such as physical activity, measured by methods developed from a Health Promotion perspective, conducted from a methodological approach of similar orientation. Consequently, it is the purpose of this chapter to present a number of conceptual elements of physical activity from a Health Promotion perspective. These conceptual elements arise in the analysis of two observation methods exploring realisable opportunities for the school food gardens to fulfil their potentials to increase physical activity. The concluding discussion proposes a role for the pledges of

the Ottawa Charter in future development of methods for investigating physical activity from a Health Promotion perspective.

4.2 Time-lapse Photography

Limited evidence of how extensively food gardens are used by schools has been published. Such evidence is important in understanding the realisable opportunities of food gardens for increased physical activity through changes to timetabling and programing of their use. Instead, evaluations of food garden initiatives have tended to address the use of food gardens by establishing and cataloguing the learning areas taught in the gardens (Hazzard et al., 2012; Yeatman et al., 2012).

Yeatman et al. (2012) presented their evaluation of the Stephanie Alexander Kitchen Garden National Program in 2012. They found schools were challenged by, but still managed to operationalize, cross-curriculum linkages to integrate their garden initiative into learning opportunities across subject areas. Respondents to the evaluation survey from Yeatman et al. (2012) provided information on curriculum areas incorporated into garden program sessions in their specific school. A majority of schools taught Science (56.6%) and English (50.9%), approximately one in three schools taught Mathematics (35.8%) and close to one in seven schools taught Human Society and Its Environment (15.1%) or Visual Arts (13.2%) However, only one in 19 schools reported teaching Health and Physical Education (5.7%) in their food garden initiatives. In fact, survey respondents were forthcoming with examples of linkage activities for all the subject areas except Health and Physical Education.

Hazzard et al. (2012) evaluated a Californian school food garden funding program. They identified that although a deficit existed between anticipated and actual garden utilisation, new, expanding and existing gardens were used for a wide variety of school activities. All current curriculum areas were included to some extent in one school or another. They reported approximately 80% of schools actually used their gardens for academic instruction, 15% used their gardens for Physical Education instruction, 13.4% for Home Economics instruction and 40% used their gardens during school breaks.

What is unclear from these two program evaluations is the likelihood of observing any of these reported uses at times outside formal garden sessions and any additional

contribution to school day physical activity gardens might make. The aim of this study is to generate an all of day view of case study gardens and gain an impression of garden use to provide evidence of the time use and purpose to which food garden areas were put outside regular scheduled garden session times.

4.2.1 Method

The food garden in School One was still-image captured each day of the week of continuous accelerometer wear time. At School Two the food garden was still-image captured on 12 days, a minimum of three wear time days for each class group. Image capture started at 8.30am and ended after 3.00pm. Signs were erected to notify members of the school community that images were being taken. Each School Principal gave written consent to photographs being taken on school grounds. Viewing of images was restricted to research personnel and the Principal.

Images were taken using a GoPro Hero 3 Black camera (Woodman Labs Inc, California). Details of the method are described in Chapter 2. A narrative analysis describes patterns of activity of persons and groups entering the garden.

4.2.2 Results

Time-lapse photography revealed garden spaces that remain largely unused outside garden sessions. The food gardens are sites for appreciators of atmospheric formations, frequented by local animal and bird life and a study of physical activity by omission. There are few exceptions to the emptiness of food gardens at Schools 1 and 2. Their infrequent occasions of use are none the less insightful into the realisable opportunities to fulfil potentials for increased physical activity. The time-lapse animations are described in Text Box 4.1 and 4.2 for School One and School Two respectively. Analytical insights are related in summary under the findings subheading. It must be reemphasised that school food gardens sat empty and unused for the vast majority of the observation period and the descriptions that follow are aberrations to the normal state of the gardens.

Text Box 4.1 School One On the first day of image capture two students enter the garden during the last classroom session of the day, approach the bean poles, crouch, stand up again, linger for three or so minutes before leaving. The Garden Specialist arrives, approaches two beds, crouching at one briefly before leaving through the rear school gate. There is no other person in the garden all that day.

On the second day, a student enters the garden before commencement of class with the Researcher, approaches the camera, engages with the camera and Researcher for two minutes before leaving. The Principal opens the tool-shed door in the company of two students and leaves immediately. The two students emerge and exit in the direction of the poultry run. The Garden Specialist can be seen in the distance in the area adjacent to the covered learning area (COLA). A student approaches the camera, records a self-expression and leaves immediately, the height of their heels giving the impression of haste. Three students enter the bed area, inspect it together, move between beds crouching several times before moving off into the distance, returning several times over the course of 15 minutes. Although obscured they can be seen moving around the area adjacent to the COLA.

The third day is the day of the scheduled garden sessions. At the beginning of vision capture, there is a substantial amount of activity around the COLA, the tool-shed is opened by the General Assistant and a small but indeterminable number of children (it appears to be less than six) move in and out of the shed. The Garden Specialist tours the garden in conversation with a garden volunteer. A number of garden volunteers can be seen entering through the schools rear gate and there is a period of 12 minutes where movement occurs consistently in the area adjacent to the COLA. Three children run to the camera, express themselves and retreat, again with obvious haste. The Garden Specialist returns with a different volunteer and tours the garden. Two volunteers return to the garden area each accompanied by a group of three or four children. The Garden Specialist joins them. This is the beginning of the garden session for the Stage 2 class. This class continues for 40 minutes. The children and volunteers leave.

The Garden Specialist and two volunteers return to the bed area. One volunteer harvests and the other is in conversation with the Garden Specialist. The Stage 3 class is seen to arrive in the COLA for the beginning of their garden session. The Stage 3 garden

session is conducted. The children leave and the Garden Specialist and volunteers return to the garden area briefly before leaving, not to return until much later. A single child returns for three minutes, during which they walk to several beds apparently retrieving objects, before leaving the garden. Three more small groups of Stage 2 children return to the garden, walk to several locations retrieving objects, one group expressing themselves to the camera, before exiting. A garden volunteer returns to the beds, crouching at several and applying a long handled tool to others for several minutes before moving to a new location. This continues for 15 minutes before the volunteer leaves. The Garden Specialist then enters the garden and starts to move between beds with a long handle tool, crouching at different beds, leaving to return with a garden hose to water three beds. At the end of the vision capture, a time that corresponds to the end of the school day, the tool-shed remains open and there are several garden volunteers working in the COLA.

On the fourth day a young child and their parent appear in the morning and begin to harvest silver beet. A conversation occurs with parents outside the fence. The child runs and their parent effects a successful recapture of the errant toddler. The pair leave seven minutes later. In the distance, figures use the rear school gate frequently throughout the day but do not appear to be accessing the garden area except one who, at the end of the final classroom session approaches the poultry run, is obscured from view by a seed raising shed, before being seen at the rear school gate.

On the fifth day, the camera angle is changed to include the poultry run and an area of the garden with an orchard and climbing bean structures. This area is adjacent to the playing fields. Three children enter and move about the poultry run leaving after four minutes. The presence of the children on the playing fields is evident at morning break and it appears two children return to class via this section of the garden. The children return to the playing fields for lunch break and again it is clear they are using this part of the garden as a thoroughfare. This area is not one in which the children linger or enact long segments of their play. During the last classroom session of the day, two children arrive at the poultry run with buckets and empty food scraps before immediately returning in the direction of the classrooms.

Text Box 4.2 School Two Two of these 12 days contained Stage 3 garden sessions. One of these days contained garden sessions for other Stage classes. Outside these times, the garden stands empty as evidenced by the many thousands of still images taken over the course of the study. There are a small number of regular activities that stand as exceptions.

Each day a large number of people, students and adults of the school community, are visible walking along the covered thoroughfare that runs along outside the boundary of the garden. The paths through the gardens are not used by children unless in the company of an adult. Such was the case when the Researcher, a student teacher and other school community adults were using the garden for a task and on the occasions when selected students briefly accompanied the Garden and Kitchen Specialists in the garden while they achieved maintenance and harvesting tasks.

The two most frequent uses of the garden outside the food garden session time are the children adding to the compost heap and the Garden or Kitchen Specialists tending garden beds. Approximately six children visit the compost each day, solo or in pairs. There is evidence that the Garden and Kitchen Specialists access the garden for their lesson preparation and that the Garden Specialist is regularly at work around the food beds at times outside preparation and delivery of the sessions. Tending the poultry is a daily task known to be assisted by small groups of children, identified on occasions by this method, but not always occurring during the hours of vision capture or in view of the camera.

A preschool group toured the garden weekly. A visiting student teacher working with one of the Stage 3 classes conducted a learning task in the garden that took approximately 15-20 minutes. Ten other members of the school community had reason to visit the garden, including an inspection by school district staff and a party of parents involved in a beautification project elsewhere in the school.

4.2.3 Findings

There are four findings from this time-lapse study. First, few children in the Stage 3 class accessed the garden area for more than fleeting and sporadic use outside the regularly scheduled food garden session. Second, the food gardens have the capacity for further use. Third, the garden is a destination rather than a location for some school day physical activity. Fourth and finally, school day physical activity occurs in view of the garden.

4.2.4 Discussion

Potentials and Realisable Opportunities

The garden demonstrates a capacity to accommodate increased frequency or duration of garden sessions. There remains insufficient evidence, however, to assert these are realisable opportunities to fulfil programming potentials, even in light of accelerometery and time-lapse analysis combined. The children's capacity to endure increased frequency or duration of garden sessions has not been established. Other school factors may impact programming potential more significantly than garden availability. Still further methods are required to establish whether programming longer sessions is a realisable opportunity.

The time-lapse data supports a conclusion that timetabling potentials for increased physical activity need to be based on local evidence. For the schools of this study specifically, there is no potential for increased physical activity from timetabling of garden sessions because sessions are not conducted during break times and each garden session is placed at a time where it will have the least impact on school day physical activity. The same cannot be said of kitchen sessions as a component of school food garden programs. Case study schools show a clear separation between the physical activity of food garden sessions and other school activity, yet there is published evidence that 40% of schools use their garden during breaks (Hazzard et al., 2012). This study supports recommendations that timetabling decisions should be made locally; the practice of timetabling sessions outside school break time should continue and any change to informal use of the garden space should be assessed for its impact on break time physical activity.

Observations and Purpose

The time-lapse observations indicate that school food gardens may have ecological potentials to increase physical activity. Gardens are demonstrably a destination for the physical activity of children completing the composting roster and tending the poultry. The gardens are also providing context to school day physical activity as school community members walk the pathways or use the garden as a thoroughfare through the school.

Social potentials can also be hypothesised from these data. It is clear the sustainability of these food garden programs is not dependent on a high volume of regular garden use outside program time. This suggests that the garden program is sufficient to establish sustainability in its own right or that the garden has other values to the school community. The number of gardens that are established but fail to reach sustainability as a program suggests the latter (Somerset & Bossard, 2009; Yeatman et al., 2012). These other values of the garden to the school may in themselves promote health and can be conceptualised as direct or indirect outcomes of the physical activity. Direct outcomes would be experienced by the garden user themselves, while indirect outcomes are the benefits achievable by the broader social group as a result of being constituted by healthier individuals.

Yeatman et al. (2012) reported use of garden spaces for emotional regulation as a component of discipline and school break recreation. These were not observed during the days of vision capture by this method. It may be that the uses reported in the program evaluation literature (Block et al., 2012; Hazzard et al., 2012; Yeatman et al., 2012) are localised, seasonal or infrequent events and it was the high value attributed to them by the school community that warranted their mention at interview. The scale of benefit for the few individuals using the garden, on the few occasions they do, may be as significant to the health of the community as higher volume uses. This suggests the purpose of physical activity in the garden may be equally as significant as volume or intensity in determining a relationship to health.

As part of the process of conceptualising a Health Promotion perspective, low-volume use of settings resources by high-need persons is a central consideration in health equity and closing health gaps. So while the design of a time-lapse protocol could be refined to

quantify time use of the school food gardens, this study has demonstrated that the analysis of physical activity from a Health Promotion perspective must recognise within the method that the purpose of physical activity is as important to health as its volume or intensity.

In conclusion, fulfilling timetabling potentials requires local information about the physical activity of school day segments and the use of gardens during school break times. Programming potentials are not restricted by garden capacity to accommodate longer sessions. Gardens contribute to whole school ecological potentials as destinations and a background for school physical activity. Developing a Health Promotion perspective of physical activity requires consideration of purpose in the investigation of health outcomes from garden physical activity.

Time-lapse photography proved to be invaluable in revealing the relatively undisturbed nature of these school food garden spaces during the school week. The gardens were essentially empty and only used sporadically outside the garden sessions for composting and tending to poultry, as a destination or providing context to school day physical activity rather than as a location for it. The gardens did not appear to have diversified in use outside session times suggesting their current use for the program sessions was sufficient for sustaining them or that they provide value from infrequent low volume use. This invites including the purpose of physical activity into investigation of health outcomes from garden physical activity approached from a Health Promotion perspective.

4.3 Descriptive Qualitative Observation

Time-lapse photography shows the physical activity of food gardens in this case study results principally from garden sessions. This makes description of the food garden sessions and understanding the nature of their physical activity an important undertaking. While the gardens demonstrate capacity to accommodate longer gardening sessions, there remains insufficient information to determine realisable opportunities to fulfil programming potentials. This also holds true for increased physical activity from attendance potentials.

Qualitative description of food garden sessions can provide context to understand the variations in accelerometery seen within and between schools. This context will identify factors that underlie the objectively recorded variation and facilitate a continued exploration of the purposes of garden session physical activity. The relationship between them reveals seven conceptual elements of physical activity from a Health Promotion perspective. Observation of the sessions allows examination of realisable opportunities to increase physical activity through increased regularity of attendance and programming changes to the relative length of garden sessions.

The aim of this descriptive analysis is to provide a contextualised understanding of school food garden physical activity in the case study schools and explore issues inherent in the settings and distinctive to the Health Promotion perspective that impact on realisable opportunities to fulfil potential physical activity increases.

4.3.1 Method

Chapter 2.2.2 provided a detailed description of the method used for video imaging. The data sources for this descriptive analysis are video images of school food gardening sessions captured at School One and School Two. At School Three data were collected in the form of field journal notes and video images recorded during tours taken prior to and immediately following garden sessions, in the absence of the non-consenting members of the school community.

Results

Observation of Schools 1 and 3 most closely resemble a description of garden session physical activity consisting of digging, raking, cultivating, soil improving, planting, watering, mulching, weeding, barrowing and harvesting fruits and vegetables. However, substantial amounts of activity – such as academic work, preparing plants for storage, child care duty, squeezing oranges for recess, running errands, maintaining tools, play behaviour, visiting and socialising – also contribute. The tasks observed at School Two are more academic in form. In the School Two Program sessions are a Garden Specialist led group presentation followed by the children being released to complete a learning task. They complete their task standing at tables prior to walking en masse around the

garden. The session concludes with the children being involved as a participatory audience to a garden task demonstration directed by the Garden Specialist.

Descriptive narratives of garden sessions from School One and School Two are provided in Appendix C. These narrative descriptions foster an understanding of the school food garden sessions as they are conducted at the case study schools. They provide grounding in the conduct of sessions for anyone unfamiliar with gardening in the school setting.

4.3.2 Findings

The principal factors underlying the variation in accelerometery measured physical activity appear to be changes to the biophysical, social and behavioural aspects of the school setting. Session form, plantings, accessible objects in the garden, persons present and interacting in the garden, and program philosophies combine to create unique conditions. Differences in potentials to increase physical activity result from the transient changes in these conditions as factors combine and recombine.

The form of the garden session was characteristic of each school and encompasses session duration and frequency differences between schools. Form influenced the lesson plan that in turn influenced the nature of the tasks children undertook in the garden and the approach the group took to complete them. In School One the form is a weekly specialist-programmed, volunteer-led, small group session. In School Two the form is a fortnightly science lesson with garden demonstrations programmed by a teacher with extensive learning support experience. Sessions vary between 45 minutes and one hour. In School Three the form is a full-day fortnightly working-bee where a primary teacher-trained, community development specialist conducts a proprietary garden program of their own crafting with a strong philosophical base emphasising personal and community development.

Variation of physical activity within and between the sessions at each school is related to the character of the plantings at the different locations. The plantings are a response to different conditions in the garden and the growth cycles of the plants. High cost capital investments such as garden beds, fencing, irrigation systems and poultry runs are in evidence. These resources influence the objectives of garden physical activity and the

options by which those objectives might be achieved. The presence and interaction of adult and volunteer participants in the garden program increase and down regulate physical activity of the children. The interactions of classroom teachers are influenced by the presence or absence of adult volunteers in the garden through changes to the teacher's roles or capacity to perform them. The gardening philosophy influences tasks through its essential processes such as composting, watering and soil improvement.

4.3.3 Discussion

Conceptual Elements of Physical Activity from a Health Promotion Perspective

Discussion of these findings from the descriptive qualitative observation of the garden sessions is provided within the context of the ethnographic methods of this study. These two approaches were integrated to inform the development of a conceptualisation of physical activity from a health promotion perspective. The research journal was used to perform a thematic analysis of data from field notes, observations of the video imaged gardening sessions and transcripts of participant interviews. This analysis revealed seven conceptual aspects in a Health Promotion perspective of physical activity. These are summarised in Table 4.1 and their derivation discussed below.

Table 4.1 Physical Activity from a Health Promotion Perspective

Contextual Factor	Conceptual Element
Transience	Subjectivity
Biophysical	Normalising biophysical diversity
Social Dynamics	Recognition of unintended consequences
Time Course	A human development time course
Adult Presence	Accounting for all interactions of the whole setting
Purpose	Recognition of a net health outcome
Physical Autonomy	Respect for the sanctity of physical autonomy

Transience

The video evidence of this study reveals gardens are changing environments where identical tasks are completed with different physical activity from one circumstance to another; the physical actions change, as do their intensity. These unique transient local

conditions are stimuli for the physical activity of the garden as it fulfils local purposes, reflects lesson planning and the social dynamic of the group. Observations of fruit harvesting and digging a planting hole provide examples.

There is a mulberry tree at School Three that is over five metres tall. The actions of harvesting a mulberry crop from week to week change. There are unique technical and physical challenges in gathering the precious early ripening fruit from among undeveloped green fruit. These challenges do not compare to those of gathering abundant low hanging fruit in full season. Neither do they compare to the more precise requirements of clean capture in harvesting late-ripening fruit now to be found only on the highest and least accessible boughs. Members of the group do not meet these technical challenges with identical physical responses.

Children digging a planting hole for a citrus tree in the exact same spot, on the exact same day complete that task with changing physical activity as was observed on one occasion at School Two. The amount of water added to the soil before a specific child took their turn had an impact. The implement the child elected, or was permitted to use, had an impact. Removal of grass that bound surface soil by previous efforts had an impact. The number of children to have recently cultivated the site had an impact. Tasks change in intensity, even before considering the skill and experience of the child or the efficiency of their action.

Realising the physical activity potential of daily living is fundamentally different to that from more controlled or reproducible circumstances common in other disciplines (Park, Lee, Lee, Son, & Shoemaker, 2013; Washburn, Heath, & Jackson, 2000). No physical challenge can be assumed to be the same between two children in these groups, or from occasion to occasion. Harvesting is not just harvesting. Digging is not just digging. The all of day session of gardening at School Three does not mean a programming potential from increased session duration is realisable elsewhere. Evidence shows sessions are not equivalent between school settings and children at other schools may not be able to endure sessions of this length in their own garden program.

Measurement by objective observation is limited to only what observers can see and interpret from their viewing (Minichiello et al., 2004). It is only the participants, with their additional subjective perception, who can discern the intensity of their experience

in completing these ever-changing garden tasks. Subjectivity is essential to a Health Promotion perspective of physical activity.

Biophysical

There are local differences in the physical activity observed in the school food garden sessions that arise from the biophysical world. Physical activity is influenced by the nature of the soil being worked and the plants being grown. These in turn respond to the climate and season. The physical activities required to garden garlic in in-ground beds on a basaltic soil in a temperate climate differed to those required to garden the "ice-cream bean" tree (Inga edulis) in a subtropical food jungle created on remediated lands. These biophysical factors are determined by immutable local variations and the physical activity of the garden is responsive to them.

These local biophysical variations interact to influence decisions in programs and practices that in turn impact observed physical activity. Practices and garden philosophy are enacted in physical activity through variations to planting decisions and garden design. Gardening strawberry plants in a vertical installation made from recycled tyres requires one set of actions. Raising cabbage seedlings in commercial, pre-fabricated corrugated iron raised beds requires a different set of actions. Garden physical activity is influenced by the attitude towards the construction of swales, use of irrigation, the application of mulch or the decision to plant green manure crops or companion plants. The video data give no indication of the origin of these programming decisions, only their outcomes enacted in physical activity. Undoubtedly other methods are required to more fully explain local variations in physical activities that have program decisions and practices as their source.

Change in the biophysical conditions of a garden will occur beyond basic ecological and programming considerations. Differences in physical activity exist not simply from one place to another, one season to another, but reportedly from one crop rotation to another, one pest attack or disease outbreak to another, one climatic event to another. It is the interaction of these biophysical factors with the needs, capabilities and decisions of the programs and participants that create different, changeable, local potentials for physical activity. Methods of enquiry that require reproducible conditions of implementation to support assumptions for generalisation are simply not suited to

circumstances with this level of local biophysical diversity. The consequence of enforcing such methods of enquiry is a screening of locations to suit programs, a driver to create gaps and inequalities by failing to identify and incorporate the needs of the screened locations. Normalising biophysical diversity is essential to a Health Promotion perspective of physical activity.

Social Dynamics

Variation in the physical activity of different sessions reflects a social dynamic in the groups. Group composition is influential in this matter, demonstrating the significance of the attendance potential in realisable opportunities to increase physical activity. The video data show expressions of occasion in a group that are unlikely to be repeated, a dynamic of the group in that moment, one of many unintended consequences of having license to be physically active in the garden. The planting of garlic at School One is an example of this.

The video data captures the group at School One developing a challenge to eat newly harvested cloves of raw garlic. Access to the water fountain in the garden in which it grows proves insufficient as compared to the number of children participating in the challenge and the amount of raw garlic being consumed by the harvesting group. Agitation grows in the activity of the group. Some group members are forced to move at speed to the next closest water source. The physical activity associated with frantic seeking of distant water is an unintended consequence of the social dynamic that developed in that session. This dynamic could not have been anticipated and may not be seen again. Consequently the physical activity of future sessions is unlikely to be attributable to the same cause and the physical activity of future garlic harvests will more likely be impacted by their own unique social dynamic. Recognition of unintended consequence is essential in the Health Promotion perspective of physical activity.

Time Course

Physical activity in the garden may reflect a stage in its members' social development. The video evidence shows that focus and turn taking are developmental goals for some members of the groups but not for others. Similarly, maintaining individual focus in an open environment appeared a noteworthy achievement for some children but not for

others. In the more academic session form of School Two, students participate in turns to achieve gardening tasks whereas at School One students receive instructions before being sent to work collaboratively in small, supervised groups. The capabilities of the group members to focus, down-regulate their interactions in the moment, and elements of the program introduced to foster their social development are factors, related to the time it takes to achieve a developmental stage, that impact on garden physical activity.

Social development is inextricably related to time, and observation of sessions provides evidence of the actions bolstering social development. The images captured in the video data are interactions in the moment, however they are likewise interactions that will influence the physical activity of potential futures. Some of these interactions are intended as discipline, others are unintended as socialising behaviours. Whether intended or not, the Health Promotion perspective needs to consider current physical activity potentials for their influence on longer term physical activity potentials related to the children's on-going development.

Similarly, in observing these sessions it is important to remember that the physical activity visible in the video footage has the influence of years of garden program interactions and experience governing it. While they may appear as spontaneous acts generated in the moment, in another sense, the video images of this study are artefacts of past physical activity and socialising interactions that have been happening in those gardens over prolonged periods of time. These interactions are evidence of a structuring of physical activity potentials that needs to be observed over sustained time courses to understand realisable opportunities.

In this circumstance, the current potential for increased physical activity is a trade off between the observable and the hopeful; that which might be enacted now as opposed to the health benefits aspired to. The health benefits may not necessarily result from increased physical activity; they may result from the ability to down regulate future activity to allow a more potent health determinant to play out (aside - like sitting inert for years writing a doctoral thesis). However, it may result in the form of future physical activity made possible because the garden experience enabled a lifestyle or necessary personal capability.

Human development is progressive over an indefinable time course and the health outcomes of physical activity potentials of daily life complex (Bauman et al., 2011; World Health Organisation, 2014). Methods to provide information on these physical activity potentials in developing humans require equally sustained applications. A time course in keeping with human development is essential to a Health Promotion perspective of physical activity.

Adult Presence

Teaching staff, Garden Specialists and volunteers were at work in the school food gardens. Directly, these interactions both promoted and down regulated physical activity. The influence is observable in the different roles the adults played during the sessions. For example, at School One the teacher was a session participant and subgroup member, mobile and engaged in the work of the session. At School Two they were quietly present, guiding, disciplinary observers and aides to the Garden Specialist, and at School Three they were a mentor for specific high-needs students.

The influence of volunteers, while only direct at School One, was indirect at all three schools. Absence of volunteers at School Three was in itself a reflection of the program principle that valued children being totally responsible for working their garden. Garden resources provided by volunteer fundraising mediate another indirect volunteer influence. These resources are evidence of activity being undertaken by the school community ‘because of the garden’ though not necessarily being undertaken ‘within the garden’. Volunteers, though they may not be present in the video data, influence the physical activity of the children directly and indirectly. Accounting for interactions within the whole school setting is essential to a Health Promotion perspective of physical activity.

Purpose

From a Health Promotion perspective, the physical activity of daily life is not simply valuable for its volume and intensity but also for the purpose it achieves in promoting better health (WHO, 2014). This was first suggested by the sustainability of the garden programs despite the emptiness of the gardens. These gardens have a value to the school that sustains them, even if being active within them serves a purpose as limited as the

food education objective for which they were established. Other studies of the health outcome of school food gardens suggest that value is in fact more diverse than the intended outcomes that rationalise the establishment of these programs (Blair, 2009; Block et al., 2012; Dyment & Bell, 2008). The importance of purpose was hypothesised from high-value, low-volume physical activities identified from the literature, and the low-volume aspect observed in the time-lapse study. The final confirmation of the inclusion of purpose as a conceptual element of physical activity from a Health Promotion perspective is demonstrated in the on-task and play behaviours of the qualitative observation.

Some of the children's play achieves garden tasks; some of their garden tasks are achieved playfully. Children are seen variously suppressing, ignoring or participating in play. Adults can be seen in the garden refocusing children at play on their tasks, mediating "mulch pile politics", granting participation privileges to group members, and fostering personal responsibility in others. The children were often waiting for instruction, passive in conversation, resting between bouts of energetic work, or disengaged from their allocated responsibilities, seemingly purposeless. These moments occur without any direct regulation. The physical activity under observation is simply enacting the lives of these children.

The activity of daily life is not necessarily more valuable in achieving its purpose of sustaining health as it approaches a maximal or vigorous intensity. While due recognition to the achievement of sufficient volume or intensity is warranted, play observed in the garden serves as a reminder that sustained volumes of physical activity, punctuated by moments of greater vigour, achieving – either intentionally or unintentionally – a determinant purpose may result in a highly desirable net health outcome for garden program participants. Other disciplines restrict consideration of physical activity to volume and intensity, reducing their focus to physiological causation rationales (Caspersen et al., 1985; Pate, 1995). This shrinks the concept of physical activity for health to a dose-response exchange, creating a barrier to social concepts. A Health Promotion perspective is not limited in that way; it has licence to explore the social health aspects that give equal standing to volume, intensity and purpose. Recognising a net health outcome from all possible health outcomes is essential to a Health Promotion perspective of physical activity.

Physical Autonomy

Each moment observing the children in their garden sessions was a moment bearing witness to their right to opt for inactivity over activity, to enact play or to stay on-task. Every action was a demonstration of their physical autonomy. Socialised, down-regulated and yet they still sought to move and, through that movement, express self and develop. Recommendations that seek to change the balance of physical activity and inactivity in school settings such as the garden, not only impose a value judgement on what physical activity will best promote health, they also risk transgressing the physical autonomy of the children participating in those garden sessions. Purpose, volume and intensity need to be reintegrated as a basis for understanding physical activity potentials in the school food garden to avoid such a transgression. The physical autonomy of these children and the adults interacting with them in this program is a critical dimension in understanding the people of a school community as the main health resource of the setting. Respect for the sanctity of physical autonomy is essential to a Health Promotion perspective of physical activity.

Potentials and Realisable Opportunities

The aim of this descriptive analysis was to provide a contextualised understanding of garden physical activity potentials and identify issues relevant to realising opportunities to achieve increased physical activity from these potentials.

The three potentials for increased physical activity of attendance, timetabling and programming are in flux with and within this environment and its management. Different communities using different philosophies with different resources in different biophysical locations create such diversity that fluctuating potentials need to be thought of as a process. Attendance has immediate influence on physical activity that occurs within the garden and group dynamics; the net result would need evaluation in each situation. Timetabling potential, while uninhibited by pressure from competing uses of the garden space, is directly related to the relative physical activity of classroom, breaks and garden sessions. Programming potential is not limited by the gardens' capacity to accept longer sessions but rather the children's subjective capacity and schools' opportunity and propensity to change the form of their garden sessions. Realisation of

potentials is a complex of school capabilities, priorities and actions with an on-going need for evaluation and management.

This discussion of realizable opportunities to fulfill these potentials has identified a number of conceptual elements unique to a Health Promotion perspective of physical activity. Understanding transience in physical challenges of garden tasks, influenced by the biophysical and social world and an essentially subjective perception, requires a particular concept of physical activity. The concept is distinguished from other disciplines in that it features factors such as the indefinable time courses of human development, direct and indirect interactions, past socialization, future potentials, purpose and autonomy. It is a social health concept where the intended and unintended health outcomes of the physical activity of individuals are reflected in the group members with whom they interact. It is a concept of health where physical activity is not necessarily the primary health outcome of a situation.

To advance Health Promotion theory, conceptualising physical activity from a Health Promotion perspective should guide the development of methods to assess it (McQueen et al., 2007). These means of assessment or measurement should ultimately reflect the same Health Promotion principles that govern the nature of their ends. Measuring physical activity in the school food garden must enable school communities, the discipline and practice of Health Promotion to achieve a common need to realise opportunities to fulfil potentials for increased physical activity, each from their respective levels of involvement. Methods that integrate measurement of volume and intensity with the purpose of physical activity have not been developed within other disciplines. They are essential to the development of a Health Promotion perspective of physical activity and Health Promotion as a discipline. Development methods such as these are the focus of the final section of this chapter.

4.4 Developing Health Promotion Methods

The analyses above have demonstrated that understanding the physical activity of school food gardens requires the development of methods for the specific purposes of Health Promotion along with the continued use of Mixed Methods methodology. Accelerometery, time-lapse and qualitative observations each have limitations as stand-alone methods, however together they reveal the necessity for Health Promotion

methods to address the broader ecological and policy influences on the school setting. Subjective information and the inclusion of existing rationalities active within a setting are essential considerations.

This case study demonstrates significant instances where subjective information is pivotal in understanding setting physical activity from a Health Promotion perspective. Perceived exertion is the only reliable indicator of physical challenge in the shovelling of compost by different groups of children. The purpose and purposelessness of physical activity can shape its relationship to health for specific individuals, such as when identical activities are variously experienced as a tortuous restriction on the urge to move while other individuals are transfixed in joyous learning. Physical activity recalled from the past, expected in the future, or governed from a place entirely removed from the garden, regulates the levels of physical activity being recorded in the moment. In these cases, understanding the physical activity of the garden from subjective information is necessary to understand the relationship between the physical activity of daily life and the interests of Health Promotion.

If Health Promotion is to contribute its unique perspective and add value as a distinct profession and discipline (McQueen et al., 2007), it must develop methods to measure the physical activity of daily life from this unique perspective. However these methods must remain compatible with the probabilistic rationalities that drive much of the existing physical activity evidence base. The profession's relevance rests on preserving its interdisciplinary capacities. Health Promotion needs to retain its ability to communicate meaningfully with other disciplines about physical activity. In part this occurs through shared objective measures. Preserving methods that measure volume and intensity, while not remaining bounded by them, will enable Health Promotion to continue the strategic interdisciplinary functions it has set for itself. The pledges of the Ottawa Charter remind us that it is the power of policy, political commitment and preserving communities' voice in influencing their own health agenda at settings level that propels Health Promotion's unique disciplinary development forward. These should be the pragmatic drivers of method development to measure physical activity from a Health Promotion perspective.

4.4.1 Ottawa Pledges as the Health Promotion Ethic

Signatories to the Ottawa Charter for Health Promotion (WHO, 1986) made six couplet pledges reproduced in Figure 4.1. The more completely an initiative fulfils these pledges the more readily it can be identified as Health Promotion. The body of the Charter itself elaborates strategies and actions for Health Promotion; however, it is the pledges that are the foundations of a Health Promotion ethic from which these strategies and actions emanate. The pledges are not only valid for the guidance of the representative countries that are signatory to them; they are an important feature capturing the conceptual nature of a Health Promotion perspective. In the task of developing methods to measure physical activity from a health promotion perspective, a framework for consistently and accurately identifying that perspective needs to be agreed upon. While concepts may rightly remain nebulous, the Health Promotion perspective must be more definitive. This thesis proposes that the pledges of the Ottawa Charter for Health Promotion (WHO, 1986) are appropriate for that purpose.

Pledges of the Ottawa Charter

The participants in this Conference pledge:

- to move into the arena of healthy public policy, and to advocate a clear political commitment to health and equity in all sectors;
- to counteract the pressures towards harmful products, resource depletion, unhealthy living conditions and environments, and bad nutrition; and to focus attention on public health issues such as pollution, occupational hazards, housing and settlements;
- to respond to the health gap within and between societies, and to tackle the inequities in health produced by the rules and practices of these societies;
- to acknowledge people as the main health resource; to support and enable them to keep themselves, their families and friends healthy through financial and other means, and to accept the community as the essential voice in matters of its health, living conditions and well-being;
- to reorient health services and their resources towards the promotion of health; and to share power with other sectors, other disciplines and, most importantly, with people themselves;
- to recognize health and its maintenance as a major social investment and challenge; and to address the overall ecological issue of our ways of living.

Figure 4.1 Pledges of the Ottawa Charter (WHO, 1986)

The pledges of the Ottawa Charter have served in a guiding role from early in the establishment of the Health Promotion discipline. In them are rendered the essence of Health Promotion; any method produced in service of a Health Promotion perspective should continue to be guided by the pledges. The pledges capture the fundamental importance of: policy, advocacy, harm minimising environments, equity, practices, rules, individuals as the main health resource, enablement, community empowerment, participation and recognition of health as a social investment, ecological issues, health service orientation and interdisciplinary interaction. Research methods that enact these pledges enact the Health Promotion perspective.

Meanwhile, communities are in no way bound to the Health Promotion perspective in determining actions in their settings. For this reason, and to avoid tokenism, the pledges must not be approached as a check-list but as a Health Promotion ethic.

4.5 Chapter Summary and Conclusion

This chapter tested the premise that school food gardens demonstrate realisable opportunities to increase physical activity from the potentials of attendance, timetabling and programming identified from the analysis of accelerometery data presented in Chapter 3. Accelerometery had proven insufficient to investigate any opportunity to realise change in these three potentials and so visual data and qualitative descriptive methods were introduced. The aim in applying these methods was to diversify information, contextualise accelerometery potentials and identify what might be the realisable opportunities for gardens to increase physical activity.

Visual data revealed that potentials for increased physical activity are in flux with and within apparently diverse school food gardens. Fluctuating potentials and realisable opportunities are best thought of as an on-going process. Attendance potentials influence physical activity through participation opportunity and group dynamics; timetabling potentials are uninhibited by competing garden uses but remain relative to local physical activity and restraints from school factors; programming potential is related to the children's subjective capacity and a school's propensity to change the form of their garden sessions. Realisation of potentials is a complex of individual and local school factors.

Time-lapse photography described food garden use at times outside programmed garden sessions. It shows the gardens have a capacity for greater use and a clear separation between food garden physical activity and other school day segments. The sustainability of food garden programs does not appear related to increased diversity in regular or high-volume garden uses outside the original program objective. The garden is a destination and backdrop rather than a location for physical activity in the school setting. Local evaluation of school physical activity and timetabling of garden sessions is necessary to determine realisable opportunities for increased physical activity.

Video images of garden sessions were analysed descriptively. The physical activity of the garden sessions was found to be a response to transient physical challenges and unique biophysical circumstances. The spontaneous social dynamic had consequences in physical activity that were unintended. The children's stage of physical and social development led to physical activity and its down regulation. Change must be monitored on a time scale commensurate with progress through the developmental stages. Interactions with other school community members influenced physical activity either directly or indirectly through the resources made available. There was evidence that the sessions were influencing health outcomes through the purpose of the physical activity as much as the volume or intensity. The lives of the children were being enacted in the garden sessions and measures to influence the physical activity of the sessions simultaneously influence the children's physical autonomy.

These observations identified a series of conceptual elements of physical activity from a Health Promotion perspective. The transient physical challenges of garden tasks influenced by the biophysical and social world reveals a particular concept of physical activity. The conceptual elements of physical activity from a Health Promotion perspective feature the abstract factors of subjectivity, normalised biophysical diversity, recognition of unintended consequences, a human development time course, purpose, a recognition of het health outcomes and the sanctity of physical autonomy. This chapter proposes that the pledges of the Ottawa Charter communicate a Health Promotion ethic and represent appropriate evaluation criteria to ensure the integrity of the Health Promotion perspective is retained the development of physical activity related method, methodology and theory.

5 HEALTH THROUGH SCHOOL FOOD GARDEN PHYSICAL ACTIVITY

The first research question has been answered in the affirmative; school food gardens have the potential to increase physical activity given local realisable opportunities. In the process of analysis, conceptual elements of physical activity from a Health Promotion perspective were identified and described. Those elements underpin the theoretical development to be undertaken in addressing the second research question of this case study. Accordingly, as respect for subjectivity was the first of these conceptual elements identified in the previous analysis, it will be the starting point for the theoretical development that follows.

The second research question asks what advances structuration and institutional development can make to school setting Health Promotion theory. The current chapter uses semi-structured individual and group interviews with thematic qualitative analysis to discover health outcomes garden program participants identify in discussing their garden, physical activity and health. The emergent themes are termed participant identified outcome types (PIOTs). Data from the accelerometry, video imaging, photography, interview and ethnography methods combine to provide evidence and context for the theoretical analyses of this chapter and the next. PIOTs have a subjective perspective at their source; it is acknowledged however that this represents one small step towards an exemplary subjective Health Promotion methodology.

A model is created in this chapter relating the PIOTs to each other. It has been named the Structuration Links Model. It is a model that is heavily influenced by Giddens' Theory of Structuration (Giddens, 1984). Construction of the Structuration Links Model began with exploration of a simple linear form to relate the PIOTs to each other; this proved to be an approach fraught with limitations associated with the reductionist causality assumptions of such models (Axelrod, Cohen and Axelrod, 2000). The limitations encountered in the exploratory modelling process suggested the use of an agent based (Marchi and Page, 2014) or complex adaptive approach (Miller and Page, 2007). Such complexity approaches have gained influence in social theory modelling (Byrne, 1998; Furtado and Sakowski, 2014; Walby, 2007) and the experience of the exploratory modelling process supported adoption of such a position.

The exploratory modelling process had identified premises and conditions that were translatable to the Structuration Links Model. These premises and conditions are related in the text below. The Structuration Links Model creates a conceptual unit that is later incorporated into an institutional development framework, to progress theoretical understanding of the development of schools as health promoting institutions.

Part one of this chapter opens with a discussion of the literature reviewing subjective perspectives of garden physical activity. The qualitative case study data is then studied for program participants' subjective rationalities around garden physical activity and its relationship to health. The health outcomes they identify from the school food garden physical activity are typified in a thematic analysis. The three PIOTs are described. In Part two of this chapter the PIOTs are modelled into the Structuration Links Model using structuration concepts to form the foundations of a deepened theoretical understanding of the structuring of school settings.

5.1 Outcomes of Garden Physical Activity from Participants' Perspectives

5.1.1 A View from the Literature

Single studies of school food gardens reflect the historical context of garden programs in which they were conducted and are limited by their purposive selection of outcome measures. This chapter develops theory from participant identified health outcomes of school food garden physical activity, without limiting the subjective perspective to a single health outcome. In this study, the subjective perspectives of program participants are modelled using a structuration and institutional development approach to provide an understanding of the breadth of these health outcomes. To be useful to the chapter's purpose and capture sufficiently broad subjective perspectives, a review of review literature is undertaken after an initial mention of single studies.

Currently, the most common singular purpose of kitchen garden programs being introduced to schools is for food education purposes (Heim, Stang, & Ireland, 2009; Hermann et al., 2006; McAleese & Rankin, 2007; Parmer, Salisbury-Glennon, Shannon, & Struempler, 2009). Programs predominantly focus on outcomes of skills based education and the making of healthy food choices (Ahmed, Oshiro, Loharuka, & Novotny, 2011; Heim, Bauer, Stang, & Ireland, 2011; Heim et al., 2009; Hermann et

al., 2006; Lautenschlager & Smith, 2007a; Morgan et al., 2010). Despite evidence citing increased physical activity as a benefit of participation in children's programs with gardening (Ahmed et al., 2011; Domenghini, 2011; Hermann et al., 2006), few have sought to promote physical activity outcomes (Hermann et al., 2006; Jacquart et al., 2010; Phelps et al., 2010). Diverse outcomes, not all explicitly from the health domain (Blair, 2009; Dyment & Bell, 2008; Reeves & Emeagwali, 2010), have also been championed in a succession of programs rolled out sporadically over time.

Theoretical studies addressing the physical activity of school food gardens from a subjective and Health Promotion perspective are not common in the literature. A small number of studies have addressed the school food garden first using subjective methods (Waliczek et al., 2001). Those evaluations of quality that have been published (Ahmed et al., 2011; Block et al., 2012; California Department of Education, 2007; Yeatman et al., 2012) are not particularly helpful in understanding the theoretical aspects of health outcomes of physical activity from a Health Promotion perspective. Studies of gardening or school physical activity that use a reductionist concept of subjectivity, that approach school physical activity from the biomedical perspective, make incorporating the insights of social theory more difficult. However, recent reviews of school food garden studies can be used to demonstrate the effect of these two factors on theoretical development.

In the last 10 years, three reviews of school food gardening have been undertaken and each reported a diverse literature apprising varied program outcomes (Blair, 2009; Ozer, 2007; Robinson-O'Brien, Story, & Heim, 2009). While qualitative studies feature in each of these literature reviews, none of them can be said to report the subjective perspectives of participants in school food garden programs sufficiently to situate theory with a subjectivity basis (Table 5.1).

Table 5.1 Reviewed reviews of school food gardening

Author	Description	Perspective
Blair (2009)	Overview of rationales for school gardening which concluded these to be: Broadening Children's Experience of Ecosystem Complexity; Place-Based Learning Clarifies the Nature and Culture Continuum; Vegetable Gardening Teaches Food Systems Ecology; Exposure to Nature and Gardening in Childhood Shapes Adult Attitudes and Environmental Values, and; School Gardening: A Broader Effect Than Experiential Education?	Critical examination of qualitative and quantitative evaluative research on school-gardening outcomes
Ozer (2007)	Summary of literature regarding the impact of school garden curricula on student or school functioning. Development of a conceptual framework and discussion of the implications of this conceptualization for practice.	A social ecological-transactional perspective of studies under review with the author's interview data discussed in conjunction with the published material.
Robinson-O'Brien, Story and Heim (2009)	Review of intervention studies examining the impact of garden-based nutrition education on fruit and/or vegetable intake, and other nutrition-related outcomes of children/adolescents in the United States.	Authors attended to the application of Social Cognitive Theory in studies under review.

Ozer (2007) found the school food garden literature to be small and developed a conceptual model of potential effects of a garden program from what she described as published observations and testimonials. Her work comprehensively describes a social-ecological framework that addresses proximal and distal effects across three social levels of the school system. What has to be questioned is the distance between that conceptual framework and the subjective inner experiences of the program participants who informed it. While ostensibly Ozer's work is a subjective investigation of school food gardening, the subjective perspectives in the published comments and testimonials were not reflections on a single issue known to respondents at the time of interview (Ozer, 2007).

There is an irony in that Ozer (2007) was arguably at greater liberty to introduce her own subjective perspective of the value of food garden programs than the participants providing the original observations and testimonials. This is a limitation of literature based conceptualising; informant participants are not being reflexive and the subjectivity of the outcome can be disputed (Rice & Ezzy, 1999). This is a reminder that subjective evidence needs to be socially constructed and reported with respect for the reflexive rationalities of the participants reporting their daily lives.

In a review of benefits to education, Blair (2009) reported a qualified support for food garden programs benefiting science achievement and food behaviour. She reported less or no support for environmental attitude or social behaviour from quantitative studies. However, the qualitative literature was found to be supportive of wider outcomes from program participation, including pro-social behaviour and environmental behaviour. Opposing impressions could be drawn from quantitative and qualitative data in these similar domains. When Blair (2009) addressed this seeming conflict of information, mention was made of a notable variation in the outcomes of qualitative studies and this was attributed to the individual perspectives expressed by teachers interviewed.

This choice of explanation demonstrates an underlying position that subjective qualitative data is less truthful than quantitative data (Minichiello et al., 2004). What is drawn into question by this explanation is the value of reviewing literature from positivistic studies in order to situate conceptual discussion of theory based on subjective rationalities. Such reflexive, subjective discussion is at the core of

Structuration theory. While studies from this underlying position can be the subject of critique, they cannot then be represented as a valid intellectual base from which to advance theory.

Finally, there is the review by Robinson-O'Brien, Story, and Heim (2009). Their review focused on a selection of school food garden literature reporting specifically on nutrition intervention programs (Robinson-O'Brien et al., 2009). The review demonstrates this is currently a very active area of investigation of garden programs, one that is dominated by studies using quantitative methods. One of the studies reviewed, by Lautenschalager and Smith (2007a), used a qualitative (focus group) approach to develop a quantitative survey (Lautenschlager & Smith, 2007b). Of the papers reviewed by Robinson-O'Brien et al. (2009), this was the most subjective in perspective; however, its ultimate objective was the development and application of a reductionist instrument. Qualitative methods such as these are designed to serve a function in an atheoretical process of method development. The inclusion of Lautenschlager and Smith's study (2007b) is a reminder to distinguish carefully between subjective studies at the nexus of positivist and heuristic paradigms (Hesse-Biber, 2010).

The most recent research on school food garden physical activity has been conducted in intervention form (Wells et al., 2014). Interventions tell us very little about how a school setting can organize itself to optimise and sustain health outcomes from school food gardens (Block et al., 2012; Block et al., 2009; Somerset & Bossard, 2009).

It is the development of the school as an institution to promote health that is of importance in understanding the effect of Health Promotion in the school setting, most especially when investigating from an institutional development perspective. Despite the methodological difficulties in providing strong evidence of the health benefits of settings (Dooris, 2006), it has been possible for Langford et al. (2014) to obtain such evidence as part of their Cochrane review of a variety of health outcomes from initiatives designed in accordance with the WHO Health Promoting School Framework (WHO, 1997). There is equally strong evidence that interventions to increase school physical activity have a limited effect in few outcomes (Dobbins et al., 2001). This is sufficient reason to persist in the development of theoretical advances in health

promotion through the investigation of settings programs with the potential for increasing physical activity in order to support the development of Health Promoting Schools. This is an outcome in keeping with the objectives of this study but at odds with much of the published literature in the area of physical activity, school food gardening or both combined.

Understanding from Health Promotion and setting perspectives the health outcomes that participants associate with their garden program physical activity is an important first step in further developing theory to promote health in the school setting.

This case study argues that the discipline of Health Promotion, through both its means and ends, its methods and outcomes, must protect the integrity of the Health Promotion perspective through a commitment to the ethic expressed in the pledges of the Ottawa Charter for Health Promotion (WHO, 1986). Attending to the voice of the community and sharing power with the people are central ethics. Subjectivity is core to the Health Promotion ethic. It has also been revealed in earlier chapters that garden programs are characterised by local differences attributable to biophysical and social factors. Programs appear to have diversified after their initial implementation to accommodate these subjective, ecological and social influences. Health outcomes, while unique local expressions, can still be typified for modelling purposes at a categorical level. This study seeks to discover these categorical types, or PIOTs, as a precursor to modelling the relationships between them.

The purpose of this qualitative study is to explore subjective connections between the garden, physical activity and school setting health and report PIOTs.

Method

Interviews were conducted with the garden program participants to explore their perceptions of the garden, physical activity and school setting health. Data from two interview sources were considered together in this analysis – the perspectives of the children and adults were analysed as one data set. Interviews with the children were conducted in a group format and used photo elicitation while semi-structured individual interviews were conducted with the adults associated with the program from the school community, teaching and garden staff.

Group interviews were conducted in conjunction with photo elicitation to enhance communication with the students (Harper, 2002). The technique allows issues to be emergent while avoiding the reproduction of learned responses and the introduction of assumptions that risk the children's sense of satisfaction at school. Group interviews with children required skilful facilitation and child friendly practices; these included choice of interview environment, pacing of discussion, establishing and reinforcing collaborative group norms and use of inclusive, supportive verbal and non-verbal communication.

An issue-focussed semi-structured interview technique was used with the adults. An initial schedule of questions was used to assist dialogue without implying undue importance in the order of the questions or their specific wording. Discussion pathways differ with each interview in response to the different relationships developing between interviewer, interviewee and their topic of discussion. In this way, the interview is a meaningful experience for both parties (Liamputtong & Ezzy, 2005). Alternatives to semi-structured interview were rejected for their potential to introduce a concept of 'one knowledge', and risk suggestion the interview was an assessment of the completeness of the interviewees' learning, training or knowing (Rice & Ezzy, 1999).

The interviews provided the opportunity to discuss the unique interactions, decisions, judgements and actions that make up the daily lives of the program participants, to explore health outcomes from school food garden physical activity and, ultimately, to inform a comparative analysis with literature-sourced concepts of Schools Health Promotion.

Equipment and Procedures

The interview method was conducted with children at School One and School Two. Class teachers vetted volunteers – a sub optimal situation was resistant to negotiation. At School One the group consisted of seven students, girls only. At School Two participants were two boys and two girls from each of the three Stage 3 classes to make a group size of twelve. There were no dropouts per se, however each child's engagement and participation fluctuated over the occasions when the method was being enacted. Those occasions were: a session of instruction on the use of camera equipment

and basic photographic principles; a group discussion probing their meaning of the terms ‘physical activity’ and ‘health’; a photographic session; and a group interview.

For the photographic session students were asked to take pictures of what it is like to have a school garden, of different objects, people, and events showing thoughts and feelings about what the garden means to them and others in the school for health and physical activity.

Interviews with the adults were conducted with all School Principals, Teachers, Kitchen and Garden Specialists, the previous School Principal of School One and the past Chair of their Parents’ Group. The interview schedule is included in Appendix A. It addresses scope and possibilities of realising Health Promotion potentials in the garden. The participants were asked to describe their involvement in the school food garden program and what they thought about having a food garden in the school. They were prompted to speak about what the garden does for the students and school community, for health in particular; any changes they would like to see; and any ideas they had on using the garden for more physical activity. They were asked how success for the garden program should be judged and prompted about physical activity specifically. The final question asked what role the participant thought schools should have in health promotion.

The interviews were conducted in offices, staffrooms, classrooms and the garden itself. Participants gave informed consent in compliance with the conditions of the University of Wollongong Human Ethics Committee. Written consent was also obtained from people vision captured in student photographs and the intended use of the images within the school was fully disclosed. Interviews were recorded digitally using a Philips Voice Tracer and 360^{o} Boundary Layer Microphone (Philips Inc). Each participant gave permission to have the interview digitally recorded and was offered a copy of their recording. Adult interviews were a maximum of 60 minutes and the children’s sessions were 40 minutes each. Field diary entries were made immediately after each interview and in later reflection sessions.

Adult interviews were transcribed in full by a transcriptionist experienced in public health discussions. The children’s group interviews were partially transcribed by the interviewer. All transcriptions were reviewed concurrently with the recordings by the interviewer to assess accuracy. The language of children in the group interview was not

always coherent. To preserve the students' tone and intention (Liamputtong & Ezzy, 2005) some quotes have a group attribution where several children collaborated to produce a single recount. Transcripts and field diary entries were imported into NVivo Version 10 software (QSR International, Melbourne) for thematic analysis.

Transcripts were coded en vivo and progressively thereafter with descriptive codes as thematic ideas emerged from the consideration of initial codes. These thematic ideas were captured in memos during the analysis. Concepts from the structuration theories, institutional development and the Ottawa Charter were evident influences. Structuration concepts included: latent, variable and extended time horizons; reflexivity and reversible time-space; contingent outcomes and unintended consequences. Institutional concepts included: the creation of social places; power as rules and resources; relationships between interactions and outcomes, and the roles of agent versus actor. The Ottawa Charter influenced concepts of physical, social and emotional health and the cross institutional nature of health prerequisites. Across the analysis process interim thematic ideas further aggregated into three types of health outcomes from garden physical activity. This typology of health outcomes was given the title of Patient Identified Outcome Types (PIOTs) as it arises from the associations participants identify between their garden physical activity and health.

5.1.2 Findings

Participant responses to questions about the relationship of the garden, physical activity and health have been themed and characterised as one of three PIOTs:

- Physiological – rendered in the Body of those who have been physically active in the garden;
- Contingent – rendered in the Person of those who have been physically active in the garden; or
- Consequent – rendered in Other than those who have been physically active in the garden; includes bodies, persons, entities and objects.

Child and adult participants equally described health outcomes from the school food garden as not necessarily or immediately producing a positive health outcome. The interviews indicate that specific outcomes, both positive and negative, may be unintended, not part of program design. The outcome may have a component of time latency or a substantial spatial displacement. Child and adult participants place a value

on anticipated and potential future outcomes of physical activity. These positive potential outcomes are spoken of with no expectation the potential health outcomes need be realised by all participants, or even a sizable number of them, in order to make undertaking the physical activity by the whole group worthwhile. Some of the outcomes were thought to justify participation by the whole group where only one or two participants were expected to experience a particular long-term effect.

5.1.3 Results

Participant Identified Outcome Types

This study found three participant identified outcome types in the school food garden.

Physiological

The first outcome type is Physiological. Physiological outcomes are rendered in the Body of those who have been physically active in the garden. The professional concept of physiology is a change in the state of the body or its systems (Caspersen, Powell, & Christenson, 1985); however, lay participants cannot speak about specific functions of the body in such terms. Instead, they use the encompassing language of "exercise" as an outcome of being physically active in the school food garden.

Exercise

The children were quite emphatic that they were getting "exercise" in the garden, even those in School Two where the accelerometer counts were relatively low during the garden session:

We get exercise for our legs standing up listening.

And when you're planting it exercises muscles and things. [Child Gardeners School Two]

None of the participants mentioned objective outcomes such as step counts or minutes at intensity; they had their own indicators of physiological work, impact or intensity. Some of those indicators of Physiological outcomes are similar to messages from

physical activity guidelines such as volume, time and intensity from walking, being sedentary or using the talk test:

The garden …You walk around you don't like sit down for like an hour at the school you get to like walk around and all that. [Child Gardener School Two]

The only passive activities we do are botanical illustration but the kids have to be in the garden doing it. [Garden Specialist School Three]

They'll be running around the outside, puffing, they've got little red cheeks and I think it's good to see them puffing. They should be puffing because they don't puff enough. [Staff Member School Three]

Non-Professional

There is some acknowledgement that a conceptual divide exists between participants' and professionals' perspectives:

I suppose it depends on what exercise scientists term physical activity too, but when there's a significant amount of weeding to be done, then the wheeling of wheelbarrows and digging and turning soil and that sort of thing, it's not a constant activity. It just depends on when planting is scheduled for different vegetables and that sort of thing. [Staff Member School Two]

When discussing the health outcomes of physical activity in the garden the program participants readily identify actions at the body level that are "healthy".

Oh it's huge it's such a physical day. The children are for every part of their body, strength building. If you're looking at strength building, the shovelling, the bending, the watering, the stretching, the moving and the carrying. You know they're very strong. So for the whole year the children really are amazing physical specimens because they can just go and go all day. (The Garden Specialist) expects them to work like adults almost, and they do! There is hardly any downtime. They're always moving and being involved and they work really, really hard. [Staff Member School Three]

Their description of how garden physical activity was healthy included diverse pathways to influence physiology, even by mental processes resulting in positive affect:

This is (a photo of my classmate) playing in the poppies and I think that is important because (my classmate) is having fun and therefore her blood pressure is nice and low. And there is close ups of poppies and they make me happy then my blood pressure is very low. [Child Gardener School One].

In the biomedical perspective physiological outcomes from physical activity only arise from gross movements or those of large muscle groups (Caspersen et al., 1985) and change in state generally requires frequent stimulus with a progressive overload (Åstrand, 1976). The participants, however, did not exclude fine motor activity:

Not that it's physical like manual labour so to speak, but it is still physical things. … They're more the fine motory sort of activities. [Staff Member School Two]

and nor did they appear to have any device to keep track of progression.

While a professional perspective might keep account of volume and intensity of stimulus strength, the participants seemed to see time spent weeding, chopping fertilising, aerating, raking, breaking clods, planting, mulching, digging in green manure, and turning compost as a healthy outcome for their body. In the participants' perspective, any activities for these purposes were a physiological outcome of physical activity.

Comments from participants seem to confirm fun and purpose as indicators of whether garden physical activity is related to health. Were physiological outcomes the highest aspiration of increasing physical activity from a garden program, a professional might simply choose the most parsimonious route to creating a sufficient physiological stimulus. The objective of any physical activity in the garden program would become to sustain a not excessive stimulus dose by whatever means. If you could get away with it, instructing children to carry objects pointlessly from one end of the garden to the other – as one could in a Boot Camp-style outdoor training session – might register as a physiological outcome success.

Interestingly, Boot Camp purposelessness seemed to be an initial suspicion held by some of the school community about the agenda behind studying the food garden program for its physical activity potential. Not surprisingly, the participants' responses confirmed that they recognise something beyond physiological outcomes.

I guess the message is that (the children) they're engaged. It's a different sort of exercise but it's a very high level you know a lot of energy is being used and there is team building. There is problem solving. They are feeling good about being out there. Self esteem. … With these children who come from families which look after them really well, very good families, but they don't let them problem solve very much. They don't know about how to work things out so this is very good. They're giving not only their body a lot of exercise but their brains, so its exercise for the brain. [giving an example] *… Ok, got to get this load of mulch over there, we've only got three people, what's the best way to negotiate the wheelbarrow today? You know, are we going to go this way or are we going to go that way?* [Staff Member School Three]

For the participants, the health outcomes of the school garden are not defined solely by the Physiological stimulus of the physical activity but also by the purpose of that action and the opportunities that purpose and action bring to the children.

It's that outdoor, get out in the garden, dig in the dirt, grow something. It's getting that satisfaction I think … You're not running a marathon but you're using your body to dig or to snip or to cut. You're using your mind and your social skills … that's giving them a life skill that perhaps has planted a seed now to say "well I'm not really into being inside. This might be an avenue for me to go into to study, horticulture or parks and gardens or whatever but something outside and starting them from this age. So many possibilities. [Staff Member School Three]

In the same sense, the children reflected on the purpose of specific moments of being active in the garden, such as being called on to turn the compost on one occasion and specifically being asked to stomp and crush the egg shells within it on another. They reflected on the one occasion when they were required to undertake a circuit of an obstacle course to win a "wheelbarrow license" or another occasion where they had planted chickpeas and were having active fun on top of the garden bed. The purpose of the activity was at the forefront of their description.

The idea of "purposefulness beyond physiological stimulus" links to the slightly facetious mention by more than one of the adult participants that the program could be more physically active if the children were allowed to indulge their inefficient practices, such as carrying scraps to the poultry run multiple times in the course of the session. The images of playfulness captured in the video data were hard to banish when hearing

these affectionate asides. Perhaps the purposefulness the participants were describing might also include the ubiquitous purposes of play not expressed spontaneously in interview. These purposes are partly the intentional objectives of participants, but not exclusively so. Unintended consequences are an inherent condition of these outcome types.

While participants readily articulated a position that gardening was exercise, their stories also acknowledged outcomes that went beyond generating the physiological stimulus with garden physical activity. They described a second type of outcome that arises for individuals who have been physically active in the garden achieving a purpose:

And the activity and the exercise isn't a goal, the end result is. They've got something to enjoy at the end of it. [Staff Member School One]

My favourite part of gardening would have to be, probably, well, I don't like weeding, it's pretty boring. I like things like how we prepare the bed and plant the seedlings and… Yeah I like planting and actually seeing what the end result of that plant is. [Child Gardener School One]

This type of outcome comes from the experience of their physical activity as having meaning or the experience that through their physical activity they achieve a purpose, even on the occasions when those outcomes or benefits are serendipitous or unintended. This is the second PIOT to be described, termed Contingent outcomes.

Contingent

The second outcome type is Contingent. Contingent outcomes are rendered in the Person of those who have been physically active in the garden. The word contingent means "dependent on" and to garner the contingent outcomes of garden physical activity, participants must be, or have been, present and physically active in the garden. Contingent outcomes are a result of the bodily experience of physical activity in the food garden developing attributes in the participants. These attributes might be found in the mind – such as learnings – and/or body – such as behaviour. Health outcomes accumulate from many sources and experiences in life and there is no suggestion that

food garden physical activity is the exclusive cause of a specific Contingent outcome in a person.

Demonstrable

Contingent outcomes are among those most consistently discussed in the participant interviews. It seems these outcomes are highly evident and valuable to the participants. These are the things that people notice or have been told and remembered about the benefits of being physically active in a school food garden. These outcomes are many and varied, experienced and enjoyed by different participants to different extents. Rather than reduce these Contingent outcomes to categories, they are presented below to speak for themselves of the diversity of health promoting opportunities.

Knowings and Doings

The Contingent outcomes mentioned during the interviews are diverse and are listed in Text Box 5.1

Text Box 5.1 Team building, self esteem, learning and honouring a specific gardening philosophy, group work, life skills, group leadership, vocabulary and language acquisition, countering the pressures of home life and marketing on children, enjoyment of school, fun, the opportunity to gather and appreciate flowers, opportunity to do tree planting, look after pets, working with friends, teaching kids from other schools, playing with the little kids, drawing, opportunities to dream, squash fruit, respond to nature, make detailed observations across time, assert and assess intuitive judgements, be witness to growth, develop confidence, draw on their own knowledge, develop and receive praise for personal responsibility, implement strategies to manage a space, connect to nature, practice systemic thinking, make choices, examine choices, gain personal empowerment, making friends, showing kindness, work with adult men, work with adult women, learn the safe use of tools, use of novel tools, develop a favourite tool, cut down trees, conduct experiments for Science curricular content, academic learning, playing with bugs and worms, chasing, being the boss, food education, food experience, eating, continuing professional development, observing a highly experienced colleague teach, watching insects, spotting different types of clouds, learning how to pick up chickens properly, learning about the wind, getting outside in the fresh air, accepting community recognition, repeating curricular lessons from the same stage over several years but with variety (an engagement issue for developmentally delayed children, a work satisfaction issue for teaching professionals), shovelling to reduce anxiety after stressful academic task, preserving childhood, build identity, drawing loved ones to school, develop and experience connectedness, growing things, climbing loquat trees, career advice, knowing to harvest only the fresh and ripe stuff, unique food experiences, and giving something back to the school.

Each of these is a Contingent outcome from garden physical activity. Each is a health outcome in that they relate directly or by degrees to the physical, psychosocial or developmental aspects of health, the prerequisites and determinants of health (WHO, 1986), or the inverse association between education attainment and health risk (Marmot, 2004).

Unintended and Inter-related

While many of the Contingent health outcomes of physical activity undertaken in the school food garden relate to the stated goals of the garden program, in this case study, program participants also spoke of unintended Contingent health outcomes, indirectly attributable to program intention or design. Play has already been mentioned in this respect. Further examples of unintended Contingent health outcomes are a reduction in exposure to insecticides in the classroom by the newly insect appreciating class group of organic gardeners and progressive desensitisation to specific touch sensitivities by repeated progressive exposure.

The participants inter-relate Contingent outcomes in stories. Here a child gardener relates physical activity (stomping compost), teamwork (turning compost with others) and the use of novel tools (auger and shovel):

Like sometimes you would have to get gumboots on and go in the compost, that was funny because you had to (sound effect) and turn the compost… I had to go into the compost and … get an auger and get a shovel and pick some up and tip it upside down.
[Child Gardener School Two]

Further to this idea of inter-relating Contingent outcomes, the children from School Two collectively constructed a vignette identifying the procedure for joining Chook Club and engaging the "kindy kids" in the poultry run. It was a demonstration of how they draw on their own knowledge, learn procedure, participate in peer teaching, and achieve animal husbandry outcomes as a complex. Each outcome mentioned is dependent on the individual participant being or having been physically active in their food garden.

Another child gardener from School Two demonstrates the inter-relatedness of the garden physical activity's Contingent outcomes of engagement, self-esteem, science curriculum, asserting and assessing intuitive judgements, learning, and fun:

A couple of weeks ago we did an experiment where we had a jar like an old jam jar and we put hot water in the jar with a straw in it and then we put it in a bucket with like ice in it and then we saw if the hot water draws up the straw … and it did … and no it didn't … With the

experiments she doesn't look at the end if they don't work. And one of the experiments didn't work because it was left all the way out. [Child Gardener School Two]

The point of this garden story was it does not matter if an experiment does not work; there is no judgement. Lots of things do not work in the garden. Presumably, it is the things that do that are important and ultimately make up the garden.

Thinking style, reasoning and resilience seemed to be other ubiquitous or unspoken Contingent health outcomes, like the missing reflexive discussion of the purposes of play. Thinking style was 'demonstrated' in the interviews more than 'discussed or described'.

The children are possibly unaware of, or unconcerned with, how rich the garden and kitchen environments are in opportunities to instigate problem solving, measurement concepts and system thinking. It is not lost on teaching staff members however, who take the opportunity to evaluate these aspects of a child's learning, so difficult to generate in a classroom situation, during the garden sessions. School One maximises use of its volunteer workforce in supervisory roles in the garden to leave the classroom teacher free to informally assess children's development, participating in the session and interacting with the children in a different way.

The children's interviews are full of stories, of individual and group construction, that demonstrate their use of system and process thinking:

Lady beetles are good for health in the garden … they demonstrates (sic) there is wild life in the garden, and they eat the bacteria and stuff … Look out for the spiders and snakes … Don't kill wild life because it is actually helping your garden to grow most of the time. [Child Gardener School One]

The worm wee and poo is good for the soil and you need worms to live because if you don't have the worms then you don't have the soil to grow stuff and then you would have to have artificial stuff just made up of stuff and then you wouldn't be able to grow anything because it's all nature. [Child Gardner at School Two]

And I like how all the weeds we have in the garden go into the compost and it breaks down then we put it into another bin or we give it to the chooks. So it's this natural cycle that goes around … I think chickens are important in the garden because they produce (sic) us with

eggs and we use the eggs in the garden (sic). Also in the garden we clean out their house and we feed all our scraps to them and that helps them produce the eggs.
[Child Gardener School One]

Even the act of drinking from the bubbler is recognised by the children for its connection to providing water for the plants directly via drainage and indirectly where the watering can also fills from the overflow tube.

We need water so that we have energy and to water the plants. And also when we are watering the plants we always put [liquid fertiliser] *in there, but we don't drink it, it's for the plants. And when we need energy 'cause there is like a bubbler up near the garden and we can go down to the bubbler that's in the garden and have a drink and go back to what we are doing. So we need water for energy and we need water to water the plants so they stay alive.*
[Child Gardener School One]

One vignette from School Two shows how the garden gives the Garden Specialist the opportunity to demonstrate process thinking in a concrete example as it may apply outside the garden. In concert with the persistent safe behaviour messages, process thinking, expounded in this way has clearly being retained by some of the children:

We get to do fun things, like [Garden Specialist]*, a couple of days ago, when we had garden, [they] said that, like, if you have a fence and then someone else's crops there, and then someone else's crops is around on this side, if you were spraying a whole lump of poison and that, you would have to test the wind to make sure that it didn't go on someone else's crop and kill it.* [Child Gardener School Two]

These abilities and experiences, provided as examples of Contingent outcomes, are a result of the children being physically active in the school garden. Take away the garden context or take away the physical activity in the garden context and the outcome is also taken away. There are other ways to achieve these outcomes but the participants nominate these outcomes as those achievable because of their garden physical activity. These are processes necessary for participating in their own immediate and life-long quest for better health from a Health Promotion perspective.

The children through their purposive physical activity in the garden learn these abilities. These abilities may be a specific skill. They may be an appreciation of the garden as a system in and of itself. They may be the appreciation of the garden as a system

metaphor. These abilities are health outcomes that remain Contingent while they are restricted to benefiting the health of the child gardeners alone. However, a garden-derived ability, understood as a resource for the school, impacting the health of non-gardening others, is a third, yet to be discussed, outcome type.

Early indication of this third PIOT emerged when the children were asked what their school would be like without their garden. At both schools where group interviews were conducted, the children's answers were loud, unanimous choruses of "Boring". Their more thoughtful comments indicated their recognition of health outcomes from their garden physical activity being experienced even by those in the school community who have never set foot inside the school garden.

Very boring because then we wouldn't have anything to cook with and we wouldn't have the kitchen and we wouldn't have the money to buy every thing.
[Child Gardener School One]

Boring because we won't get to plant stuff and we wouldn't get to eat all the healthy food and it won't show the little kids how to plant things and how the garden works.
[Child Gardener School Two]

The kids won't learn about the fruit and vegetables that we plant and how they work.
[Child Gardener School One]

Because the garden has won us heaps of awards for the school and the kitchen.
[Child Gardener School Two]

The beneficiaries nominated in these comments are the finances, "the little kids" and the award recipients of "the school" and "the kitchen". The children acknowledged outcomes that were not constrained to their own exclusive benefit or entertainment. Health outcomes from the garden physical activity in those who have not been physically active in the garden themselves are termed Consequent.

Consequent

The third outcome type is Consequent, that rendered in Other, not those Bodies or Persons to have been physically active in the garden. Consequent outcomes have a health effect in people who have not themselves been physically active in the garden.

Consequent outcomes extend beyond the personal experience within the school food garden and arise as the result of someone else, at some time, having been physically active in the school food garden.

Consequent outcomes of physical activity in the school food garden are the "legacy" of the participants' garden physical activity. The children in this case study reflected explicitly on their legacy speaking about the produce, the learning opportunities of others in the school and even the impact on finances and the school's outreach into the community. Consequent outcomes are as evident to the children as the Physiological vitamin D they will declare they are producing or the Contingent teamwork they noisily demonstrate. Consequent outcomes of garden physical activity are not abstract and ethereal to program participants; they are tangible like produce, abilities, resources and reputation. They are recognised and attributed by the interviewees as relating their garden to the health of their school setting.

Consequent outcomes impact people distant from the garden by time, space or both. A time distance may be the result of a consequent outcome that is immediately evident but persists to remain an influence in the school and community over an extended period of time. Examples of these are the garden itself, produce from an orchard planted by others in the past, and cultural change in the school. Alternatively, impacts of consequent outcomes may be time distant through a long latency period, where the impact exists in a potential form, possibly for years, before being realised. Health outcomes brought about in the community by an ex-gardener applying program learning or even the establishment of a volunteer network are time distant examples of consequent outcomes.

By contrast, space distant Consequent outcomes represent impacts from garden physical activity on a social group that is geographically removed from the immediate school community. Visitors to the school may be impacted by garden outcomes or produce. These Consequent outcomes may turn up in communities distant from the gardens in which their source physical activity occurred. Shared learning, program materials and even impacts on class sizes of other schools might be considered among space distant health outcomes.

Six local and immediate consequent outcomes spoken about in the participant interviews are described below.

The Garden

The most obvious Consequent outcome of physical activity in the school food garden is the existence of the garden itself. The garden influences health outcomes in others beyond those who have been active in it. It is an ecological backdrop to school life. Before and after photographs of the gardens of these three case study schools illustrate how, after cumulative years of school food garden physical activity, a garden has been left behind. Each garden in this case study occupies what was previously over-shadowed, partially-grassed, transition areas adjoining school parking lots and bus turning areas.

Even assuming it were possible using other means to achieve similar Contingent outcomes in the children in the absence of the garden, even assuming those children could have had identical physiological stimulus delivered by other means in the absence of the garden, there would still be no garden. There would be no garden at the end of weekly Boot Camp or weekly worksheet sessions or longer lunch breaks. The garden is a consequent outcome because it retains for years to come the potential to influence the health of those who have not been physically active within it.

The Produce

The produce grown in the garden is another direct Consequent outcome of garden physical activity.

Last week I had the Year 6's because it was their last day, sowing seeds for next year. So making sure that they knew how to sow a seed. Also that they were leaving kind of a legacy for next year so that all the seeds that they have sown, the kids will plant next year. [Garden Specialist School One]

This seed stock is an enduring Consequent outcome of the many previous gardening groups. The produce participants consume might be considered a Contingent outcome:

I say when I'm introducing, "I really need you guys today in the garden … because it's not going to get done otherwise." So they know they need to be up there if they want to get the capsicums and they want to get the potatoes. [Garden Specialist School One]

The produce that is used to feed visitors, or for other purposes within the school community, is a Consequent outcome. One example of this is when produce was used in catering for a Principals' conference held at School Two. These meetings are necessary to the administration of non-garden initiatives run by the Community of Schools (CoS); the meetings themselves are intermediary to school setting initiatives in the CoS; those initiatives impact on the health outcomes of those distant schools. As explained for Contingent outcomes, there is no suggestion that the garden physical activity resulting in the produce is exclusively responsible for the outcomes of the Principals' meeting. The produce is one of many small influencing factors facilitating the interaction between the Principals and the production of those outcomes. The nature of these interactions will prove to be an important aspect of later theorising on institutional development.

The feeding of Principals featured in all three schools, described in a familiar fashion in each; – perhaps a symbolic offering to the embodiment of school authority. The interviews suggest that the well-nourished Principals, resident and visiting, enthuse at the experience of interacting with the school gardeners directly but also indirectly through the garden produce being served as luncheon. The enthusiasm was described as having a stimulating effect on their commitment to their vocation, the public education system in which they lead schools, and a heightened engagement with items of the day's business. These comments were made in earnest and the capabilities of the children were genuinely something the Principals appreciated about their work.

While well-fed Principals might not appear to be a major health concern, other health aspects of the produce that becomes their lunch cannot be disputed. The Principals' food was local, organic produce with a small carbon footprint and has a health consequence for the community because of this. The parents of the school food gardeners were given an opportunity to experience pride in their children's achievements as the gardeners' relate the story of their offerings; this has a health consequence for the families. Children relate in detail how their parents openly admire their gardening and cooking skills. Were it not for the garden physical activity there

would be no produce to perform its part in the system, to add its small influence to a complex. These small Consequent outcomes of the garden physical activity accumulate to result in better health, a hypothesis the children could likely comprehend from the system thinking they demonstrate in discussing their garden.

Garden produce also creates an income stream, contributing monetarily to the school's economy, making it a Consequent outcome of the garden physical activity. At School One excess produce is bartered for processed goods, like flour, through a local organic store. At School Two excess produce is sold to staff and the community through the school office. At School Three, a hot luncheon is available for staff to buy on Kitchen session days. In all three cases the proceeds are returned to general revenue of the school and lend support to other non-garden projects.

At School One the produce is transformed into gifts to thank the volunteers who have participated in the school over the course of the year.

(The children) basically washed the vegetables, peeled them, chopped them up, did all the measuring, did all the washing up, had them cooking in the pots and then toddled off. … They were gifts that we gave to the mums that washed the aprons and the helpers that come in and volunteer for the lessons and we sent some up to (the Garden Specialist) to give her garden volunteers … it is important for the children to be involved with thanking them. So we've just done some cards, we got some photos done… (for a seasonal garden calendar to sell). [Staff Member School One]

The photographs and lavender decorating the gift cards came from the garden; the volunteers enhanced sense of community and propensity to engage is the Consequent outcome of the produce. This vignette also demonstrates the potential for time and space distant Consequent outcomes of the garden physical activity. The gardeners have a latent experience and learning from participating in maintaining the volunteer network and their participation in this craft industry that may go on to have Consequent effects in a time and space distant community. These abilities, put to use in the gardeners' future, to create health outcomes elsewhere, can be credited as Consequent outcomes of their present garden physical activity.

If the produce were consumed or removed from circulation in some other way by the garden program participants themselves, it would not be a Consequent outcome, just a

Contingent one for their personal benefit. If the photographs and gift cards made from the produce were spirited away home by the children and only used amongst themselves, again they would only be a Contingent outcome. It is not until, in a distant future and place, a child gardener, just one, takes what they learned in garden class and goes on to establish their own craft industry version of Hallmark, or national land rehabilitation initiative, or launches a political career to protect a World Listed forest that the Consequent health outcome is realised by others. While the school food gardeners are able to nominate the immediate Consequent outcomes of their garden physical activity recognising the full extent of Consequent outcomes as they move further from their source of garden physical activity becomes progressively more difficult; that is not to say it becomes progressively less important to health.

Enrichments

Some Consequent outcomes are intangible enrichments. The children of these schools, before they even step foot into the food garden, join a school body where the senior students have years of regular exposure to these complex garden places, full of living metaphors and challenging vocabulary. These language experiences are cultivated within the programs, meaning that they are Contingent outcomes in the child gardeners themselves:

It's good because it filters into the classroom as well. We have spelling words and all that sort of stuff so it's all related to what we do here as well. [Staff Member School Two]

The children with little English, they're the group leader and they are going "oh wow, normally I'm not allowed to talk because I can't, and then all of a sudden I'm the leader. [Staff Member School Three]

However, these Contingent language outcomes in the gardeners become part of the language environment of the non-gardening school body. Through interaction between these two groups, the language environment of the non-gardening members of the school body is enriched. This is the Consequent outcome. Change in educational attainment or ability of non-gardeners resulting from interactions in this enriched language environment is a Consequent health outcome for the non-gardeners resulting from garden physical activity.

The description of a Kids Teaching Kids seminar at School Two was a clear example of this:

It was basically the Year 6 children taught. We had children from all different schools come over. The children got together a bit of a skit and it demonstrated soil testing and talked about worm composting and recycling and they did it probably for about 20 minutes. … They presented, we hosted it here and … 10 different schools all brought so many children 10, 20 children and they broke up into groups and they all taught each other something. It was really good. [Staff Member School Two]

Language enrichment for these non-gardening – and in this case space distant - students – is the legacy of the garden physical activity of the child gardeners. Vocabulary enrichment of this kind was mentioned at both schools with families from disadvantaged backgrounds.

Volunteer Networks

Volunteer networks are a Consequent outcome, separate from the Contingent health outcomes volunteers may gain for themselves working in the garden. The volunteer networks are as much a product of the garden physical activity as the produce. They grow and are strengthened by physical activity of school community members being present in the school food garden, however the network's actions may exert influence anywhere in the school. Even knowing there is the possibility of help from a network of linked people, without them ever acting in any way in the school, has a value and is a Consequent outcome of the garden physical activity that spawned the network.

Each school demonstrated volunteer networks at different stages of development, evidence of the time latency that might be expected for some Consequent outcomes. At School One where the school community was rich in volunteers, Consequent health outcomes of the garden physical activity included the community learning of how to maintain such a network. At School Two the volunteer network was in the process of being strengthened beyond the Parent Committee that had funded the original garden infrastructure and the community was coming into the school to draw on the garden program as inspiration, a model and source of resources for new initiatives. At School Three, significant barriers to establishing a volunteer network were being overcome by gradual engagement through the garden-resourced kitchen sessions rather than direct

involvement of volunteers in the garden. The relationship of garden physical activity to establishing a volunteer network in this school was necessarily through the intermediaries of produce and cooking.

The volunteer networks are a legacy that continues to serve the school beyond the food garden but which came into existence because of physical activity that occurs in the food garden.

Professional Networks

The professional networks, program procedures and materials of the food garden themselves are also Consequent outcomes of garden physical activity. Often thought of as prerequisites, all the teaching and garden staff spoke about the evolution of these aspects over the course of development of their gardens.

The interviews with the adults are full of references where professional colleagues are learning from one another, admiring pedagogical style, and where peers are modelling professionalism. They are taking the opportunity to network, extend and share their particular skills:

(Without the garden) I think we'd do science a lot … differently. I just think it's fabulous because it gets the kids out of the classroom and (the Garden Specialist) just has …. a fabulous way of looking at things. Like the way (the Garden Specialist) does things I look at it and you would never have thought to do it like that. I suppose if I was in that situation I might, but I look at the things that (the Garden Specialist) does and I think "Oh gosh you're wonderful". … just has such a spin on it and … does these beautiful drawings and I think gosh. My poor children don't get drawings very often and if they do they laugh at them. [Staff Member School Two]

There are multiple references in the interview data to the informal professional development that characterises how teachers learn peer to peer as a Consequent outcome of the physical activity of the garden sessions in which they have been involved.

In School One, the Learning Support Teacher and the two program specialists tailor program materials for the school. In School Two enriched lesson plans are captured in the Scope and Sequence. These documents have been shared with other schools making

them Consequent outcome of the garden physical activity in each of these cases. School Three is a special case, the Garden Specialist is an external commercial provider, so the Consequent outcomes at the school level also exists in their experience of collaboratively negotiating a successful, commercially provided program among a Community of Schools.

School Three shares their understanding of how the garden programs could be brought into being elsewhere with the great number of schools that visit this garden:

You could easily transfer this to another school. You could do that or I could do that because all you're doing is you're taking an ethos, you're changing the way the kids are eating. You're changing the composting system. You're making the compost and then you're making some garden beds so it's all coming across then and I can do the things (the Garden Specialist) does easily in a little way in every school. [Staff Member School Three]

The Consequent outcome of the garden physical activity in this school is the knowledge of what it takes to develop a sustainable garden program and promulgate it to other schools. It is not just an act of design or imagination but equally the garden physical activity that is the source of that transferrable experience of creating a sustainable program. The materials from School Three were shared with other individual schools and programs developing the establishment of school food gardening to primary schools on a wider basis:

(Another program).. *they'd used … our stuff… our stamp. Our environmental impact statement that all the schools have, they've got ours… (we) gave it to them. … So they're using a lot of our ideas. … So we started before them and a lot of the things they've used.* [Staff Member School Three]

During the time conducting the case study in these gardens, interactions between professionals from other primary, secondary, tertiary educational institutions, State and National, government and non-government organisations were observed. These interactions and the professional development process they demonstrated are all evidence of a Consequent outcome that the garden's physical activity is having on the personnel in those schools. Take away the garden activity and the need to interact in these ways is diminished.

Aesthetics

The improved aesthetics of the schools are powerful Consequent outcomes of the garden physical activity. They influence social inclusion, staff retention, community out-reach and provide the children with a meaningful experience of working for change. Aesthetics have a serious formative effect on the school setting.

These food gardens change the social mix of schools by changing their enrolment numbers and the families that choose to send their children to a school within area:

So this school was perceived as the school you wouldn't come to, years and years ago but in the last 10 years we've doubled in size. Whereas the other two schools have dropped in (this area) and I think that's mainly, if you talk to members of the community, they're all aware that we've got the garden and the kitchen. … So it's recognised in the community as being something really positive and something different. [Staff Member School Two]

They have an impact on the status and satisfaction of the teaching staff:

Every school that comes (on a school visit) says "can you do this in my school" and I say "yeah but someone pay me. [Staff Member School Three]

The importance is recognised but not over stated.

A lot of people have heard of it and in the community of schools and in the region or area, will say "oh I've heard that's a beautiful school". (One staff member) went to a professional learning day last week and the person running it said "oh (this staff member) comes from the best school (in the region)" and people have said "I'd love to work at your school" that kind of thing. I don't know if it's only the garden or if it's the atmosphere, if it's the look of the place. I don't know. I think it's probably the whole package but nobody's sort of said "oh you've got a garden and so that would attract me here" sort of thing. When they come in and see, the whole package, there are a lot of people interested.
[Staff Member School Three]

Attracting and engaging diverse, quality staff in low socio-economic schools is no small matter. The belief was often expressed that a beautiful school is important to the children through the development of "school pride":

I think they know that other kids don't have (a garden like this) because down here we do have a lot of crossover with other schools and they go and visit other schools for their sports days and things like that. The grounds here are quite stunning compared to perhaps other grounds, … They've got so many different diversions here. They don't get bored I don't think. They have just enough stimulus to keep them from becoming too old too quick. [Staff Member School One]

Beautification in other areas around the school is achieved using skills learned in the garden. Sometimes those skills are put into practice by the volunteer network, sometimes by the children engaging with other local environmental groups or recreating Tolkien's Middle Earth in the flowerbed outside their classroom. Beautification plays a significant part in the motivation of the children, however it has also achieved health outcomes beyond indulging and enchanting them. At School Two beautification was a first line strategy for re-engaging families that might otherwise have been considered at risk; it was the food garden experience in the school that normalised the initial approaches to them. Being involved with the garden confers a high status in the school and the community. This is somewhat to the puzzlement of the Principal, who is perhaps anticipating plans in place for the realisation of the next round of garden developments:

It has a high profile within the community and I actually think to some degree it probably has a higher profile than, not than it deserves, but, than is warranted, for what it is providing (at the moment). It's evolving all the time. [Staff Member School Two]

This change in status has improved the community access:

The profile that it gives the school allows some outside agencies and community groups to approach us to use. We've got (the local branch of a national community organisation) and we've got other community groups that are doing workshops in our garden space on, whether its propagation, whether its worm farms and all that sort of thing. They're coming in and they're doing those sorts of activities so there's an expansion further into the community. Like with actual community groups utilising (the garden) rather than it just being word of mouth within the community about what it provides.
[Staff Member School Two]

Gardens, and the garden aesthetics, make the schools more accessible to community groups and the funding associated with them. At School One the kitchen has been architecturally designed for exactly this purpose. The food garden program has received financial support and donations of equipment from a local specialist food company that uses the dining room periodically as a venue. The kitchen is used after hours by local chefs for cooking schools. There is an on-going relationship with members of the local community that is fostered by specific actions relating to the kitchen and garden through weekend markets held at the school. Bus tours visit the garden and buy produce.

Aesthetics impact on more than the surface of a school setting:

There is also an environmental restorative process that's happening (here) at the same time. Because we are on a really really compromised land and the students have been involved in and creating the change. [Garden Specialist School Three]

School Three has unique environmental challenges. Recognition of the aesthetic creates a profound and interactive experience of environmental change, one the children feel and embody. A whole other study would be required to assess the Consequent importance of the empowering metaphor these children are living in bringing change to a damaged living system. The children know their gardens as systems; teachers revel in the use of this knowledge. The children in these schools have witnessed the redevelopment of an old shed into an architect-designed dining room. They have witnessed the streetscape of their previously overlooked school, a sad half grassy expanse overshadowed by imported pines, replaced with food beds so full of produce there is no room to plant more, even in the first months of winter. The next generation at that school will see an indigenous orchard established to feed them Lilly Pilly and Quandong and other local food species. At another school, they will play soccer under an avenue of native fig trees planted in preparation for anticipated climate changes. They have bird song.

You're looking at what the kids are getting out of it and we're just sitting here listening to birds. Well we didn't have any birds 10 years ago. It was just all coal dust. … No, there were no birds' nests or birds, but thousands of lizards and if (the children) saw an insect they killed it. Yes, you see, now everyone's bringing the lady birds back to the garden. [Staff Member School Three]

They have a lived understanding that change is progressive, incremental and is a system phenomenon. The aesthetic of a school, as well as its ecological features, ought to be considered seriously by anyone studying school setting Health Promotion. The Consequent outcome of garden physical activity also includes the potential of those children taking this aesthetic experience and moving out into wider society, taking this with them into their more adult lives, retaining healthy environments for no other reason than their aesthetic appreciation.

5.1.4 Conclusion

Participants in the school food garden programs identified connections between garden, physical activity and health. These subjective connections were analysed, themed and reported as three participant identified outcome types (PIOTs) of garden physical activity. Evidence was provided to explain the nature of the Physiological, Contingent and Consequent outcomes. These three PIOTs typify the subjective rationalities of program participants.

The individual PIOTs are meaningful as unique categories, however their theoretical strength comes from their relationship to each other. There remains a need to envision this relationship between them. The purpose of modelling that relationship is to show how the health outcomes of the garden physical activity promote school setting health beyond the limits of the program and into the structural features of the school setting.

5.2 Relating and Realising Outcome Types

The PIOTs typify subjectively identified health outcomes emanating from garden physical activity and the school setting interactions and features enabled by that activity. A model that relates the PIOTs to one another would be useful to facilitate discussion of physical activity for a health purpose in the school setting. Such a model might play a role during community consultations, planning and strategic reflection. It might help stakeholders identify the full scope of impact a garden program has in the school setting. Such a model, if presented in a suitable, accessible form, has the potential to facilitate communication between school communities, academics or professionals from Health Promotion and other disciplines. Most importantly, such a model would ground setting development objectives in the subjective understanding of the school community

while keeping the process compatible with a vast body of existing social theory. Strengthening the subjective with some accessible theoretical modelling might enable school communities to remain – or become increasingly – self-sufficient in the process of keeping themselves and their setting healthy.

To achieve these objectives the model must have a solid theoretical base and demonstrate linkage to other social theories and frameworks. The majority of the second section of this chapter will describe a model that relates the PIOTs to each other using structuration concepts from a highly theoretical position. This is both to advance Health Promotion theory and to enhance communication about school settings physical activity health outcomes with a lay audience. This latter aspect of the model will be illustrated in the final sub-section of the chapter after the theoretical case has been established.

Modelling the relationships between PIOTs is complicated by two factors. Firstly, theory from the Social Sciences is an abstract specialist knowledge but needs to remain accessible to community persons and policy makers. Using the existing social theory of Structuration to model the PIOTs also involves underpinning subjective outcome description with this specialist knowledge to ensure the model remains compatible with other social theories. Secondly, health outcomes are realised time and space distant from cumulative moments, in different locations, that are at their source. The model must remain simple while encompassing the dimensions of time and space in seeding and realising health outcomes. The value of modelling the PIOTs is in prompting the school community and other stakeholders to discuss the diversity of physical activity health outcomes in the school setting from the past, present and future to help identify ways increases might be realised in them.

5.2.1 Structuration and a Duality Model

Structuration is a social theory that imagines structure and agency as a duality and attributes a primary significance to time-space location. Giddens (1984) explains the duality of structure and its relationship to the action of agents:

Structure (is) the medium and outcome of the conduct it recursively organizes; the structural properties of social systems do not *exist outside of action but are chronically implicated in its production and reproduction*." (Giddens, 1984, p.374).

Structure viewed like this is the means and ends of social activity, inseparable from agency, thought of by some through the metaphor of the two faces of a single coin (Rütten & Gelius, 2011). The daily physical activity of people – agents – is inextricable from the production and reproduction of structure. This makes the study of activity of everyday life central to Structuration theory and Structuration theory congruent with the study of the physical activity of everyday life.

There are two generalizations that can be made about the garden programs from Structuration Theory alone. Firstly, garden programs structure 'conduct' in the case study schools, even if their immediate influence is initially thought to be limited. Secondly, garden programs are brought into being by human agency, with due acknowledgement of their progressive accumulation of rules and resources. Thus, raw physical activity in the garden shapes and is shaped by the interactions of individuals in the school community over time. The health outcomes of this activity shape and are shaped by the structure of the school setting. The school setting shapes and is shaped by raw physical activity. The garden physical activity and PIOTs are engaged in a fragile but perpetuating cycle. Modelling the outcomes provides an opportunity to consider the underlying power school Health Promotion initiatives possess to accomplish structural change in school settings.

The Structuration Links Model can extend beyond the understanding of physical activity as being contributory to individual health outcomes alone, as is common when thought of as exercise, to embrace an understanding of the simultaneous contribution of the same physical activity to social health outcomes. Through the PIOTs, and the familiar lens of social relationships at school enacted in physical activity, this structurating process is readily understandable as a way school setting health outcomes are achieved. Such a model offers a way to communicate how health outcomes arise from people acting out their daily lives and interacting with each other.

It is important to note that change to promote health from physical activity from a structuration perspective does not privilege increase in physical activity over structural development. A structuration approach focuses on developing setting structure (not simply setting ecology) as the principal means of changing the health of persons within a setting. Physical activity is a prerequisite and a consequence of structural change.

From this perspective increasing the physical activity of people in a school is a means to achieving a purpose that promotes structural development. Increased physical activity is not sufficient of itself; without a structural driver, the increased activity is likely to be a temporary aberration. The structuration perspective is the counterpoint of intervention programs that commonly introduce physical activity that targets specified objectives and is not sustainable after resources for the intervention expire (Oakley, 2005).

Intervention models establish significance through changes to the normative distribution of the group (Minichiello et al., 2004). In a structuration approach, motivations should not be assumed to be in pursuit of an equitable or normative impact. Equally, physical activity of agents that achieves a purpose should not mistakenly be evaluated as if it were intentional, reasoned or causally motivated. The relationship between physical activity and purpose might only be identified reflexively or in the motivations of others. This is apparent in the evidence where garden program participants stated they were motivated by hope for individual children; not all children, not all children to the same extent, and not all garnering benefit in the same way. To some participants, just one child going on from the program to make a difference in the world justifies the program.

A structuration approach differs from an intervention approach in the importance unintended health outcomes can acquire. To one school community, relieving the food insecurity of children from one family at risk and the continued preparedness for similar situations in the future justifies their program. Introducing a child to their life's work or imbuing a community with a sense of beneficent preparedness, are valued consequences of greater physical activity enabled by school setting initiatives from a structuration approach. The embodied, active, interactions of daily life that enable these health outcomes are not a program objective but the base nature of structuration.

Structuration theory styles recursive rationalities. One could argue, as a reflexive approach, it simply accommodates the less common incidence of strategic intent with justification. The fundamental focus of a structuration approach is on time and space in the interaction of agents living their daily lives, producing or reproducing structures through social conduct in virtue of structure's duality, not in service of it (Giddens, 1984, p.374). Structure is within that social conduct, not as a skeletal framework but as a resilient pattern of interaction. Structural change arises from the duality; it is not an

objective of it. Social interactions, expressed and enabled through physical activity, result over time in health outcomes, the nature of which are determined in large part by members of the community engaging in reflexive consideration. Creating frequent opportunities to encourage reflexive consideration in the school community increases structuring possibilities. Such a process of reflection by the school community, understood through the use of a structuration model, promotes the possibility of changing health outcomes, promoting more that are positive and some that are intentional.

From a Health Promotion perspective the Structuration Links Model described below represents an opportunity to embed subjective purpose in a shared reflexive understanding of physical activity for health and promote health outcomes from physical activity whether those outcomes were intentional or not.

5.2.2 Elements of the Structuration Links Model

The three elements of the Structuration Links Model are the three PIOTs- Physiological, Contingent and Consequent outcome types. Permanence in the association of elements within the model is a necessary feature because all the PIOTs have the same moments of physical activity as their source. The elements of the Structuration Links Model need to be inseparable if the outcomes they model are to remain comprehensive in scope. The three elements of the Structuration Links Model are related by subjective rationalities not causal relationships. Modelling rationality relationships differs considerably to modelling causal ones.

Rationalities are fluid, experience-based understandings, reasoned reflexive thought that readily, partially or unreliably appropriate scientific and causal proofs. The relationships between the three PIOT elements must remain generalized, influencing linkages to reflect fluidity and profoundly express the influence of space and time in structuration conceptualization (Giddens, 1984, p.40). Additionally, rationalities fluctuate in strength; that strength is dependent on a net outcome of influences from structuration concepts such as understanding through rules, resource allocations, self-regulation, normative boundaries, contextuality, contradictions, power and control, and historicity. Consequently, rationalities need to be modelled with linkages that allow slippage.

Such elements and their unique relationships require an ingenious modelling device.

Figure 5.1 A Mobius band used to represent the duality of structure and agency (http://hammerofsilver.deviantart.com/)

A Device to Capture Time, Express Duality and Enable Rationality

The fundamental device for the Structuration Links Model is the Mobius band, illustrated in Figure 5.1. It is a shape that permits the construction of a connected, influencing, but essentially fluid form of rationality relationship between PIOTs while retaining structuration's feature of capturing time and space. The Structuration Links Model is an assemblage of three of these devices in a chain-linked arrangement such that each PIOT remains in contact with the other two. Figure 5.2 illustrates the Structuration Links Model representing the school food garden setting of the case study. The permanent connection of three Mobius bands as links representing the three PIOTs creates a single, three-dimensional unit able to form linkages with other units.

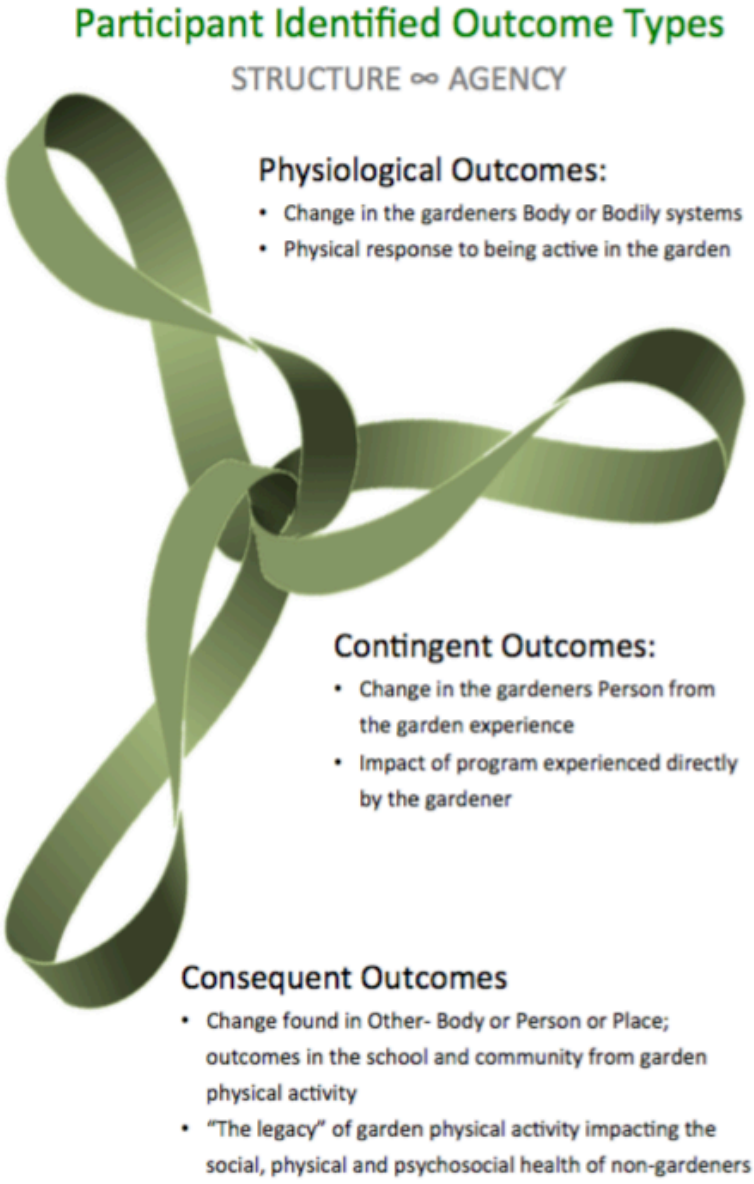


Figure 5.2 The Structuration Links Model is a linkage of three Mobius bands representing the participant identified outcome types

The linkage of structuration units – and ultimately the chain mail fabric that results from the recurrent physical activity of the setting (Figure 5.3) – will be a metaphor extended in Chapter 6 to theorize on institutional development. Understanding the metaphor of the Mobius links and units is the foundation of understanding the metaphor of the fabric from which societies' levels are constructed when the Institutional Development and Analysis Framework is eventually introduced. The remainder of this chapter explains the Structuration Links Model through this metaphor and concludes with a lay description and discussion of the model's applications.

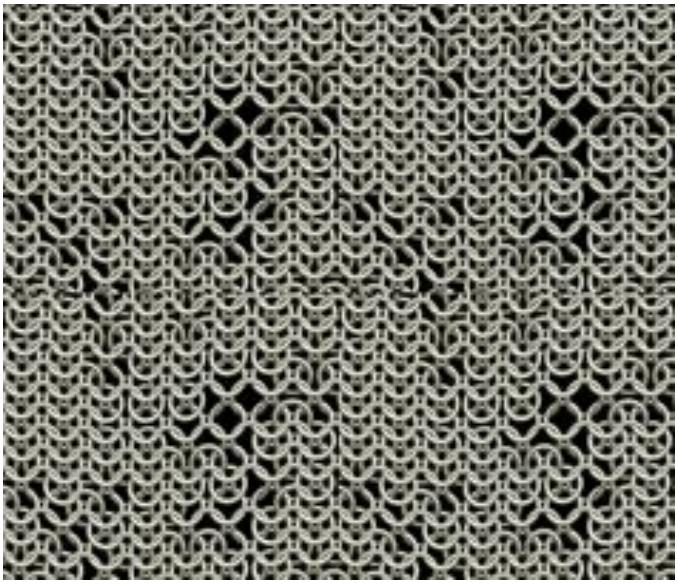


Figure 5.3 Chain mesh fabric is used as a metaphor for connected Structuration Links

5.2.3 Relating the PIOTs

A Mobius band is an infinity device. By introducing a twist into the crafting of a link, a single plane is made. Cycling around the band, each side remains opposed, of the one entity but distinct in the moment. However with the passage of time, cycling around the band reveals that one side has lead into and arisen from its opposing face. The band is in essence the dual faced structure: agency coin metaphor of Rütten and Gelius (2011), now portrayed in a device that captures time allegorically in its form and creates an enduring self-perpetuating relationship between structure and agency.

Structuration Theory is profoundly affected by time concepts in time-space boundaries and the time dimension inherent in reproduction and a process focus. While structure and agency are always on opposite sides of the link, they exist, in fact, through the passage of time, on one continuous plane. They are discrete in the moment but continuous across time. This is a better metaphor on which to model reproduction of interdependent and mutually reinforcing concepts. Structure and agency remain a perpetual duality in the moment and a unity over the course of time.

In the Structuration Links Model, an individual Mobius link represents each of the three PIOTs

For Physiological outcomes, the link represents Body. Distinguishing the opposing faces of the link draws on a social theory conceptualization of Body in keeping with the work of Shilling (2003) citing Goffman (1990) and Turner (cited in Shilling, 2003). This is a concept of Body as a material structure onto which texts are written; where Physiological structure is the body incarnate and Physiological agency is the body somatic. As one introduces time into thinking about this PIOT, the body incarnate has been made corporeal by that myriad of physiological processes that cannot exist in a moment frozen in time, unsociable without the body somatic.

For Contingent outcomes, the link represents Person. Different parts of the complex of systems that constitute Person are being referred to as the structure, depending on the specific outcome under consideration. If the Contingent outcome is a learning, the structure is perhaps mind, perhaps ability or morality, perhaps behaviour or expectation. As Contingent outcomes are characterized by the interrelatedness of their impacts, it is just as sensible to think of conjoint structures constituting Person. People are complexes – they learn and develop. They construct themselves socially - they reconstruct themselves socially; they act and understand. Time entrenches agency in Person through a structured capacity to willingly engage in action.

For Consequent outcomes, the link represents Other in two modes. Other might be Person, the only difference to the Contingent PIOT being the added condition that the relationship of Person to the garden physical activity is time and space distant. Other might alternatively be a non-Person entity; in this case, the structural aspects of non-person Other are readily recognized from Giddens' representation of structure being composed of rules, resources and power (Rütten & Gelius, 2011) and the agency aspects are the associated creative action.

5.2.4 Relating the Links into One Unit

The relationship between PIOTs is interdependent and permanently co-located by virtue of their common source in common physical action. That source is the physical activity in the garden. The three elements must remain in a permanent relationship to each other as a single linked unit, however each PIOT must be able to cycle; this is how time boundaries are rendered within the model. The links must be able to accelerate or resist the influence of any or all of the other cycling PIOTs as they interact within the linked

unit. The mobile linkage between the three Mobius links represents the fluid subjective rationalities that underlie the PIOTs, unconstrained by restrictions of empirical causal linkage, occurring as moments of influence between the PIOT's respective 'faces' of structure or agency. Over time these momentary nominal distinctions between structure and agency of specific PIOTs diminish in importance as the process of structuration proceeds and the unitary nature of the outcomes takes over.

The interaction and on-going cyclic movement within the unit exemplifies how outcomes from physical activity may facilitate or impede other outcomes of different types. Perhaps muscular strength is facilitating skill acquisition and the creation of a fence or some other permanent garden feature to be enjoyed by the school community. Perhaps academic engagement is impeding antisocial interactions that impede inclusion in break-time game play. Perhaps strong, antisocial children participating more frequently in game play initiate unintended consequences, the preexisting structure of the school important in determining whether the outcome is pro-health or not. Irrespective of the exact nature of interactions that manifest themselves in daily school life, they are examples of the linkages acting as a unit.

The notion of slippage between links cycling within the unit enables a necessary aspect of a model based on subjective rationalities. Slippage is essential for permitting situations where the community believes something to be true (e.g. you need to have strength to make compost), the causal relationship of which could be disputed with evidence (e.g. you need to learn how to use a pitch fork efficiently). Alternatively, slippage might be required where professional belief (e.g. children are more aware of mathematical principles when physically activity in the learning experience) is disputed by the school community for relevance in their lived experience (e.g. if garden sessions are too academic they are not as engaging for at-risk students).

The objective is to relate garden activity and the diverse rationalities of the school community into a foundational unit of health outcomes that can be understood by the community and stakeholders and modelled into the structural development of school settings. It is the subjectivity and rationality positions that form the basis of the model that allows for enduring achievement of the structuring process and school setting development, despite the fluidity of these positions.

The Structuration Links Model prevents the idiosyncratic rationalizations of specific communities from inhibiting structuration; unique patterns of rationalization simply change the structural outcomes for the setting. Unlike intervention approaches, structuration approaches normalize diversity. A different school structure might be produced if children who did not consider themselves strong were practicing skilled compost making and reducing the school's carbon footprint. A different enrolment profile might exist for a school that celebrates the concrete mathematical opportunities of the garden compared to the profile had they implemented a non-academic program. In either case however, health outcomes from the structuration cycle have still occurred. The particular idiosyncratic rationalities that link these outcomes are not the point; what is important is that the rationalities will structure irrespective of whether the community are intentional and involved in the decisions or not. To develop a school setting that is health promoting becomes a process of taking up the structuring power of the community's rationalities. To do this the single units of the Structuration Links Model will need to be integrated into a more comprehensive institutional development framework, which is the objective of Chapter 6.

5.2.5 Premises and Conditions

The examples provided above are illustrative. The premises and conditions that define and constrain the relationships between PIOTs in the Structuration Links Model were derived from an exploratory linear modelling. Although the linear model produced little more than a situation specific mapping of perceived benefits to individuals, theoretical situations arose that helped identify necessary restrictions that have been adopted in the Structuration Links Model. Three premises and five conditions were articulated that proved equally appropriate in the application of Structuration Theory to the modelling.

The premises for the Structuration Links Model are:

- that physical activity is at the source of all types of health outcomes from school food gardens;
- there are relationships between the types of health outcomes that can be modelled, and;

- an occurrence of one health outcome influences progress of an occurrence in other outcomes.

One concludes setting health is a net result of accumulated physical activity outcomes.

These three premises are as applicable to a structuration model as the causal linear model through which they were identified. The first premise necessitates physical presence, as opposed to intellectual presence; the minimum requisite to arrive, be active within and leave the garden establishes the fundamental context for the time-space relationships of Structuration Theory. The second premise guards the scope of outcomes identified by participants, legitimizing the subjective process and maintains the relationship between Body-Person-Other as the foundation for setting health. The third premise prevents the outcomes being represented as disconnected actions and occasions and imbues the model with the capacity to represent social health observed within the setting.

Further to these three premises were five conditions that remained relevant when Structuration Theory was introduced to the modelling process. The conditions for the Structuration Links Model are:

1. Outcomes may be unplanned, unexpected and/or recognized reflexively. This is represented by the infinite combination of positions of contact these links can assume and the possibility of their movement in either direction. In keeping with Sewell's axioms (Sewell, 1992) even so called 'planned outcomes' are profoundly influenced by social forces beyond the intention of agents.
2. Outcomes may have a positive, null or deleterious effect on health. This is represented by the unpredictable and indeterminate progression of the three links in the unit as they pull on each other, PIOTs might generate a turning force in each other or slip without friction, creating movement in either direction or none.
3. The magnitude and direction of an outcome does not prejudice the magnitude and direction of other outcomes. This is represented by the uncoupled pull one link makes on another. The direction (higher, equal or lower) and magnitude (non-significant, small or large) of one PIOT acting on another does not determine the direction and magnitude of the other PIOTs. A small deleterious effect can be overcome by a large positive effect in the other PIOT.

4. Disputes between rationalities do not prohibit structurating progress. This is represented by slippage in the movement between links and the subsequent resolution of the friction that also occurs such as in the resolution of conflicting subjectivities through acceptance of difference and contradictions or dismissive rationalization and dominance of opinion.
5. Outcomes have no exclusive cause and represent different accumulations of effects. This is represented in the use of a linkage unit to explain the bounded dynamic of Action Situation. The PIOTs act within time space boundaries. While their geometry accounts for the infinite time course, it is the representation of their links spinning in place that accounts for the spatial location. Later, by connecting units into a mesh like structure, a larger model of the setting can be represented. The linkage of single units represents translation of influences from other programs and non-school locations and contexts. The multiple pathways through the mesh represent the non-exclusive causes and different pathways' influence that may accumulate to achieve any one observable outcome.

The positional possibilities of the links demonstrate the three-way interface of structure:agency moments progressing through time, skipping, slipping and having an inevitable but unpredictable influence on each other. The health outcomes of physical activity are equally inevitable and unpredictable. The links have a permanent connection but an impermanent bond or relative position to each other, much like the common source physical activity of the PIOTs they represent.

Privileging one PIOT over the others would be a failure to recognize the full value of the physical activity and would compromise the health of the setting by abdicating the opportunity to style outcomes the communities are seeking. It is worth expanding on this point briefly before continuing the explanation of the conditions of the Structuration Links Model.

The losses sustained as a result of privileging limited outcome types speaks to a fundamental advantage of settings approaches over interventions in promoting health through sustainable development of communities and institutions. This advantage becomes evident when subjective rationalities are given their due value and participant identified health outcomes become the subject of theoretical modelling. This advantage

emerges as a convincing rationale for continued investigation of Health Promotion settings through theories of structuration and institutional development.

Interventionist approaches are inherently prescriptive, reductionist and, unless setting based, are insufficiently complex in the types of health outcomes they aim to achieve (Aggleton et al., 2010; Warwick et al., 2005). Their programmed uniformity and positivist paradigm, evaluation frameworks and dissemination strategies actively discourage variation (Oakley, 2005; Rabin, Brownson, Kerner, & Glasgow, 2006). For this reason they are limited to Physiological and Contingent outcomes, capable of acknowledging health impact in only the body and person of those present. Consequent outcomes exist in the unique social settings of communities and their broadest, most enduring motivations. The prescriptive nature of intervention programs inhibits development within communities and as a result inhibits the co-production of Consequent outcomes. Communities are forced to subvert the objectives of interventions if they are to achieve this full scope of health benefits from initiatives (Friend et al., 2014; Haggis, Sims-Gould, Winters, Gutteridge, & McKay, 2013). A better result is available to them through settings initiatives that do not privilege one PIOT over the achievement of others.

To conclude the premises and conditions of the model, it should be noted that the form of the linked unit represents the non-causal rationality basis of the Structuration Linked model. There is influence within and between different PIOTs, represented by the different properties of contact between the links – turning moments of one on the other, slippage, drag and blocking. These are representations that model the fact physical activity does not need to be motivated by causal or empirical evidence. Being active for one purpose will have health outcomes for other purposes. All physical activity will have impact on Body, Person and/or Other, the magnitude and direction of which will remain obscured and unrealized unless considered as a health outcome by the community or community members. Links facilitate movement in each other but they are not permanently coupled, which allows them to spin forward and backward, representing reflexive thinking. Investment by the school community in the reflexive process will optimize the health outcomes of physical activity in a school setting, producing intended and unintended outcomes.

5.2.6 Lay Description and Applications of the Model

The second section of this chapter described a model that relates the PIOTs to each other using Structuration Theory. This Structuration Links Model, its elements, metaphors and applications, have been constructed with the objective of community accessibility in order to enhance communication about school settings physical activity health outcomes with a school audience.

It is recommended a non-academic audience is provided with a concrete learning tool in the form of Mobius bands to enable them to manipulate and experience the continuous plane which will be used to communicate structuration concepts of reversible- time and time-space boundaries. Communicating structuration in a tactile model, such as illustrated in Figure 5.4, and encouraging them to link several of these bands, is a crucial aspect of the subjective conceptualisation of the PIOTs and living up to the voice, power and investment pledges of the Health Promotion ethic. In a description of this model to a community, non-academic or non-social science audience, creating the experience of handling a concrete manipulative of a Mobius band allows the geometry to communicate physically the structuration concepts of time and space in perpetuity.

Figure 5.4 A concrete manipulative for communicating structuration concepts of time and space boundaries

The Structuration Links Model has potential uses in community engagement, resource planning and developing school settings. Unlike Health Promotion models driven by implementation of actions and strategies, this model focuses on the power of existing programs to structure the school setting from a local, subjective case-for-change, shaped by a Health Promotion perspective and ethic.

The preamble to using this model must include a proposition that to be active in daily life affects health outcomes of self and others, within the group and even wider than the group. After the local PIOT outcomes have been discussed, and any local objective measures have been thought about, the model becomes an illustration of social health. The outcomes the community identify become evidence for the community themselves of how the physical activity of one child can bind them inextricably to the health of the

group and the wider community. Articulating the local PIOTs brings a school community's attention to the simultaneous objectives of achieving the purposes of their daily lives and the consequence to health of their physical activity.

The conceptual task of valuing the full scope of health outcomes that physical activity achieves is then coupled to the realistic task of being more active in conduct or service of an established program. This is the opportunity for school Leadership to involve the community in realising opportunities for increased physical activity while remaining focussed on achieving the many purposes of the program. An example of this is to draw the school community into discussion of how the garden might perform a role in an emerging issue on the school community agenda. At Schools 2 and 3 this approach was used to draw on the success of the school food garden to instigate a lively expectant process of school play area development. By focussing development on realisable opportunities, individual and group purpose and extending existing programs, the model represents a tool for school Leadership to facilitate continued structuring their school setting with a pragmatic and progressive optimism.

While the Structuration Links Model has been developed in a school garden program, the process of its application is identical were it to be trialled in an established program of a different type in a school setting. Personal responsibility programs, remedial studies, dramatic arts or instrumental music programs come to mind from those observed in the case study schools. The process is simply one of exploring the physical activity outcomes of an existing program through the subjective process steered by the Structuration Links Model, analysing the information with the school community and, if they are ready to take action, engaging them in a local investigation of the volume, intensity and purpose to identify realisable opportunities. The more able the school community is to operate the process without input from an external source, the more likely it is to be able to use this process in progressively more setting contexts and programs. The capabilities the Structuration Links Model develops should prove transferable in promoting on-going structural development in the school setting by the continued application of Health Promotion theory.

The model could be applicable in a variety of circumstances: when the community is ready to identify the outcomes of their existing programs and to discuss their local

potentials to further realise opportunities from active-learning; in chaotic school settings, to engage members of the community through their recognition of the full health effects of a program and prompt expression of their priorities; and to take children's understanding of systems in their garden and incorporating them into the discovery of the consequences of their garden physical activity on themselves, their surroundings and the people with whom they share them.

The ideal situation for application of any model is where leaders in a school are capable of drawing on objective and subjective information to further engage their school community in the decision making of successful, sustainably resourced, established programs (WHO, 1997). The strength of this model is that it does not need the ideal situation; in fact it assumes that the ideal situation is a utopian end point not a prerequisite for starting. In applying the model the initial intellectual process is to create a reasonable representation of the program's physical activity outcomes by PIOT.

Leadership is important in translating a subjective understanding of the outcomes of the program into a structuring cycle for the school setting. Tackling the change process by staying focused initially on the development of a single program pilots the local issues. A small-scale success in understanding a single program such as the garden program and beginning to see how the school structure develops through it can happen ahead of any broader implementation agenda. The community involvement that begins in a garden program could go on to influence other programs at a measured pace, ultimately involving the whole school setting in actively engaging in structuring through physical activity from a Health Promotion perspective.

5.3 Chapter Summary and Conclusion

Exploration of school setting Health Promotion theory using structuration and institutional development concepts challenges paradigmatic assumptions in existing food gardening and physical activity literature. Chapter 5 has taken a methodological and theoretical approach that respects the subjective rationality of garden program participants.

The qualitative analysis in this chapter explored subjective connections between the garden, physical activity and school setting health. These were typified and reported as

three participant identified health outcome types (PIOTs) of garden physical activity - Physiological, Contingent and Consequent outcomes. The generalised features of the PIOTs are described with reference to the qualitative data from this case study.

The Structuration Links Model was created by a subsequent theoretical analysis using Structuration Theory to propose relationships between the PIOTs. The Structuration Links Model is a duality cycle model that unifies, over the passage of time, the agentic actions of daily life and the influence of social structures. The unique geometry of the model relates time- and space-distant settings health outcomes with the momentary duality of agency and structure observable in interactions of garden physical activity. The model relates health outcomes to school setting development and social health.

The Structuration Links Model translates the physical activity and health rationalities of school food garden program participants into a conceptual unit that represents the on-going processes of structuration within the school setting. Thus, the foundation of social structuring is represented as an outcome of bodily action and the reflexive cognition of subjective rationalities. These social structuring processes perpetuate and the model represents the production and reproduction of structure from agency and agency from structure. With the application of the Structuration Links Model, social health can be modelled from the activity of daily life in an institutional setting.

This model is the first of two theoretical advances in setting Health Promotion emerging from this case study. It is a foundational component of the second theoretical advance, to be presented in the following chapter. In chapter 6 the Structuration Links Model will be incorporated in an institutional development framework to promote, capture and leverage the understanding of the actions and reflexive cognitions of daily school life into broader process of creating health promoting school settings.

6 HEALTH PROMOTION THEORY FOR THE SCHOOL SETTING

This chapter presents a further advance to school setting Health Promotion theory and explains a community accessible model of institutional development for use in the school setting. An existing theoretical proposition is extended to include the theoretical developments of this case study, remodelled to emphasise the multi-level form of the Institutional Analysis and Development (IAD) framework. The remodelled and extended proposition is communicated in a visual language familiar to non-academic users. A metaphor is developed to communicate structuration and institutional development concepts as a tool that can develop non-academic users' understanding, planning, enacting and structuring of their school setting. The aim is to assist Health Promotion professionals and lay persons in hypothesising transition of established Health Promotion in Schools initiatives toward the more encompassing ideal of the Health Promoting School. This chapter describes the theoretical components of the model and explains the model in terms of its metaphor readying for the final chapter in which application of the model is explored. The chapter concludes with a narrative description of the model for a lay audience.

The theoretical question of this case study asks: *What advances can be made to school setting Health Promotion theory through structuration and institutional development?* The evidence of this case study in school food gardening enables the question to be approached in two ways. In this chapter, structuration and institutional development will first be considered as abstract concepts within a theoretical construct. This construct incorporates the Structuration Links Model developed in this study. Second, structuration and institutional development will be considered as concrete processes evident in the daily activity of schools settings that can advance theory in a participatory manner. This dual approach continues a commitment to achieve Health Promotion ends through means that are consistent with the ethic of Health Promotion.

The chapter advances the theoretical concepts of structuration and institutional development by enriching the existing theoretical proposition of Rütten and Gelius (2011) with the Structuration Links Model from Chapter 5. The extended theoretical proposition is described with a reemphasis of the IAD framework's multi-level form. The non-academic visual language of the institutional model enhances understanding

and communication within school communities and other lay people in the change process. The new model, named the ReInterplay Model, is designed to be used as either an abstract professional device in its basic form or to be customised by the school community as part of an enduring practice of local setting development. The ReInterplay Model is described in the terms of a virtual environment where the reader is asked to imagine being taken on a virtual tour before a lay explanation is given. The chapter concludes with a description of how a Health Promotion practitioner could use this theory and its model to engage a community to develop and implement some kind of HPS action.

6.1 Developing the ReInterplay Model in an Accessible Medium

Community accessibility should characterise Health Promotion theory (Potvin et al., 2005). It is necessary so as to avoid entrenching a power differential in the process of achieving the fourth Ottawa pledge:

> *to support and enable (people) to keep themselves, their families and friends healthy through financial and other means, and to accept the community as the essential voice in matters of its health, living conditions and well-being.* (WHO, 1986)

Theory that is accessible only to a privileged professional group can only be an interpretation of a community perspective, ultimately disempowering that community to act in their independent interests. Theory that is comprehensible only to Health Promotion professionals elevates those professionals to the position of an essential resource, tying community health to levers that regulate interaction with that resource. Theory that is unintelligible to non-academic persons holds no opportunity to stimulate higher order policy conversation about setting health among members of a community. Inaccessible Health Promotion theory is a burden on health.

The medium through which a theoretical model is conveyed has the potential to facilitate or impede community accessibility (Tufte, 1997). The IAD framework is a formidable framework on which to base a setting model, having a number of complex conceptual elements and context-dependent levels. Academic training endows a reader with the capability to take such information, mapped out in line and ink schematic drawings on a page, to incorporate several other theoretical concepts, often only

textually referent, and to draw understanding from this conglomeration as a connected explication of social activity. These are alien experiences to lay persons. To access abstract and theoretical knowledge in the absence of academic training, community members need to communicate in a medium and visual language familiar to them from daily life (Gee, 2003).

It can be argued that an increasingly sophisticated visual language is developing in the community and that science communicators need to develop their skills to engage with community audiences (Estrada & Davis, 2015). Community members develop sophistication in their own visual language as a result of direct or indirect exposure to graphic forms in their common daily experiences (Gee, 2003). Such experiences include use of multi-level computer games, virtual real-estate tours and infographic maps for navigating public locations. Such common daily experiences create a visual language and set of skills that offer opportunities to communicate complex, abstract, multi-level, concepts in a community accessible form (Serafini, 2011). To achieve the pinnacle of modelled theory – communication prompting participation – requires a process to re-contextualise theory for community members (Luzón, 2013). One way of achieving this is by engaging community members to assume responsibility in the design process and to encourage their modification of a base theoretical model to represent local conditions and understandings of the theory and setting.

If it were common for science communicators to have graphic skills, or access to individuals with graphic skills, then the ReInterplay Model would have been presented here, in this thesis, as an animation, co-designed in collaboration with school community members. As the reader, you would be viewing an avatar that represents you in first- and third-person views moving around a virtual environment consisting of four floors connected by a staircase, entry on the top floor from an elevated outdoor ground level. Each floor would represent a level of control underpinning the school setting. The floor plans for those four floors would be laid out and furnished as identifiable zones representing the elements of the IAD framework. A community member of the design team (or their avatar representation) would be explaining to you the power of objects and features of the zones. You would be playing and experimenting with these powers. You might even be asking children for help to understand.

Instead of an animated model of this visual world, this chapter will present a conceptual draft of that model. Eventual realisation of such a virtual model is more possible because this conceptual draft begins within a larger vision of a co-designer relationships and enduring iterative processes of setting and setting theory development.

6.2 Innovations to Preserve from an Existing Proposition

In 2011, Rütten and Gelius published the Interplay Model that was influenced by Health Promotion research they had conducted in a community setting. Their theoretical proposition links Structuration Theory with institutional development and a selection of elements/actions/strategies of the Ottawa Charter. Although the Interplay Model does not translate to the school setting, there are three innovations in the Rütten and Gelius proposition that could be further developed for Health Promotion theory in institutional settings.

Firstly, integration by Rütten and Gelius (2011) of Ostrom's IAD framework (Ostrom, 2005) with Giddens' Structuration Theory (Giddens, 1984) produces a multi-level process view of the school setting open to ethnographic analysis. Secondly, there is their recognition of the importance of Sewell's change axioms. Sewell (1992) developed a more robust, social theory driven, understanding of change and the influences of time and precedent in its application. Finally, these three theoretical components are unified with fundamental elements of the Ottawa Charter for Health Promotion (WHO, 1986).

The Interplay Model (Rütten & Gelius, 2011) itself is not entirely successful in communicating the component theories of the proposition. The graphical form of the Interplay Model (Figure 6.1) largely obscures, and therefore inhibits, the potential of the IAD framework on which it is based. The multi-level nature of the framework, which makes it ideal for representing Health Promotion in the school setting, loses its potency. Powerful aspects of structuration and social change are relegated to textual side notes. The Interplay Model simply disappears the strategy of reorienting health services, as if the co-presence and interaction of multiple institutions of a society can lead to change through a multiplicity of linkages at only operational and collective choice levels. These are limitations that must be addressed in a theory suitable for school setting Health Promotion.

The remainder of this chapter undertakes to develop an advance on the Interplay Model (Rütten and Gelius, 2011). It will be called the ReInterplay Model, so named in respectful recognition of its origins. The ReInterplay Model will attempt to address the initial difficulties of applying the Interplay Model in a school context and deepen institutional explanations by returning the emphasis to the multi-level form of the IAD framework. The ReInterplay Model will focus on the processes underlying perpetual structural change. It will incorporate the Structuration Links Model and metaphors into this extended theoretical proposition to address reorientation toward other institutions, such as schools, the family and the health system. It will do these things cultivating community accessibility through compatibility with a visual medium of communication.

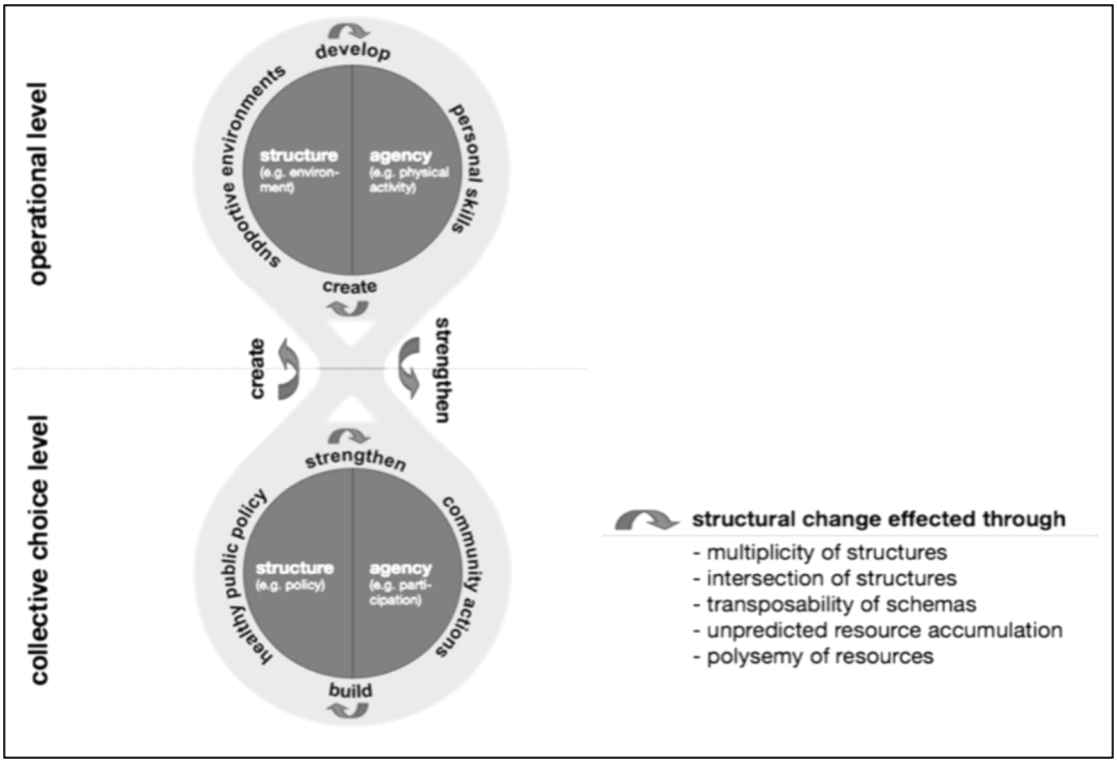


Figure 6.1 Interplay Model described by Rütten and Gelius (2011) as depicting multi-level interdependence of structure and agency in health promotion

The explanatory context of schools as social institutions stretches from the smallest and most intimate of daily settings through to the largest of meta-constitutional circumstances. The elements of the IAD framework maintain a linkage that is comprehensible despite this extraordinary scope from schoolyard to socio-political systems (see Figure 6.2 on the facing page). There is no lay or academic view of society too vast nor setting too small that cannot be accommodated as an explanatory context within the form of the IAD framework. The ReInterplay Model refocuses on the IAD framework to harness its capacity to relate the daily activity and interactions between people in local school settings with those between people in far removed places of power. Those who engage with the ReInterplay Model gain insight of the importance of their embodied action and reflexive cognition in structuring health-promoting institutions.

The Interplay Model was an inspiring representation of the production and reproduction of structure from agency and agency from structure. Sadly, it was also one that is incomprehensible to lay and community people and not well suited to represent health in institutional settings. To enable a more comprehensive modelling of setting health from the physical activity of daily life in a school it is necessary to incorporate the conceptual units of the Structuration Links Model, allow the re-emergence of the multilevel form of the IAD framework and represent this in a way that lay and community people can use to communicate their understandings. This requires a reimaging of the component theories of the original theoretical proposition.

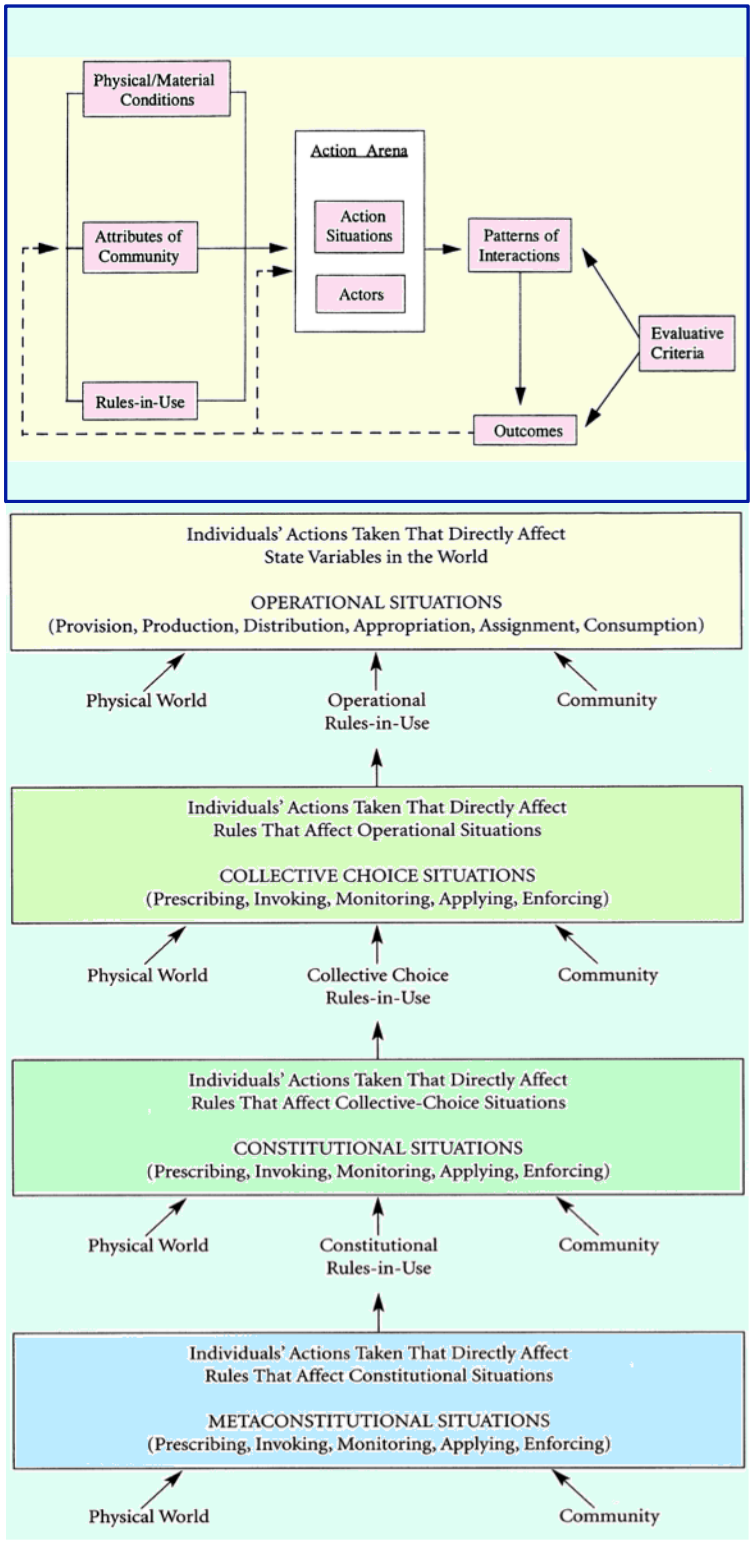


Figure 6.2 Schematic representation of an Action Situation and the Operational, Collective Choice, Constitutional and Metaconstitutional levels of the Institutional Analysis and Development Framework (Ostrom, 2005)

6.2.1 Component Theories of the ReInterplay Model

The PIOTs are a key contribution of this study and a valuable advance on the theoretical proposition put forward in the Interplay Model (Rütten and Gelius, 2011). As a theoretical device, the PIOTs enable the translation of physical activity of daily life and participant rationalities into an explanation of the production of settings and setting health outcomes. These setting outcomes span physiological to social concepts of health. The positioning of health causality as one possibly minor aspect of health rationality within a predominantly social theory is a distinctive feature of the Structuration Links Model. Integrated with the rigorous theoretical underpinnings already associated in the derivation of the Interplay Model, this feature serves to empower the rationalities of a community thus achieving a further step towards Health Promotion theory within a Health Promotion ethic.

The Structuration Links Model relates the PIOTs forming a single conceptual unit. The power of this conception lies in the linkage of units and their material role in structuring an institution. A single unit captures a representation of the perpetuating process of structuration from moments of physical activity and reflexive cognition occurring within a setting. The geometry of the links constituting a single unit enables the time- and space-distant effects of garden physical activity to be seen as continuous with the eventual health outcomes of that moment of physical action in the garden. There is an accumulation and enmeshing of those single units into a fabric of moments spatially related to the school setting. This chain mail of moments represents the accumulating opportunity of agentic setting interactions permeated with a perpetuating structurating process. While the Interplay Model introduced structuration (Giddens, 1984) and structuration change concepts (Sewell, 1992), it is the Structuration Links concept that advances an explanation of the underlying codes of this changing social fabric.

The ReInterplay Model is a return to the foundations of Rütten and Gelius's (2011) exploration of the interplay of structure and agency. The foundations of the theoretical proposition remain a combination of the IAD framework, Structuration Theory, the Theory of Structure and the Ottawa Charter described by the Interplay Model. In light of this case study, the extended proposition now includes the PIOTs and Structuration Links Model and a strengthened concept of physical activity from a Health Promotion

perspective. The ReInterplay Model draws more directly on the elements and broad organisation of the IAD framework as described in Ostrom's work *Understanding Institutional Diversity* (2005) to organize the other component theories. Of the component theories, structuration theories (Giddens, 1984; Sewell, 1992), including those developed within this case study, are the most pervasive and the on-going application of the Ottawa Charter for Health Promotion (WHO, 1986) the most essential.

The remainder of this section presents a description of the component theories of the ReInterplay Model, their relationship to the IAD framework and its elements. The chosen approach is to describe the component theories before reintegrating the extended collection of components and elaborating on the united model.

Institutional Analysis and Development Framework

Each level of the IAD framework is comprised of three general subgrouping of elements, termed holons: Action Arena; Outcomes and Evaluative Criteria, and; Exogenous Factors. Interaction within the IAD framework has a particular dynamic as effect is generated on and between levels of the model. Each of these will now be described with reference to the case study.

Action Arena

The Action Arena is the focal element of the Institutional Analysis and Development (IAD) framework. It is a social space as much as a physical one and Action Arenas include the Action Situation and the Actors themselves. Ostrom (2005, p.13) described an Action Situation as the

social space where participants with diverse preferences interact, exchange goods and services, solve problems, dominate one another … fight (or undertake some particular thing) among the many things that individuals do".

Technically, an Action Situation is described by seven characteristics:

1) participants;
2) positions;
3) potential outcomes;

4) action-outcome linkages;
5) the control that participants exercise;
6) information; and
7) the costs and benefits assigned to outcomes.

Illustrating these seven characteristics, one action example in this case study is a subgroup of children, senior students at School One. They should be working as a team, harvesting crops to sell; they can choose to watch passively, play or complete their assigned task, as part of their responsibility to fund the future garden program and fulfil their civic duty while concurrently learning about cottage industry.

Understanding who the Actors are in any Action Situation is more involved than just identifying those sessions in which participants are present. Important considerations of the Actors in the Action Situation are the number of participants, their attributes and any socially cohesive factors. Actors are known by four factors:

1) the resources that an Actor brings to a situation (such as previous experience of harvesting and the ability to work in teams)
2) the value Actors assign to states of the world and to actions (such as avoidance of running afoul of a discipline system or funding a program they are leaving)
3) the way Actors acquire, process, retain, and use knowledge contingencies and information (such as whether a sense of fatigue or a judgement of the intensity of their previous activity determines a need for rest); and
4) the processes Actors use for selection of particular courses of action (such as whether their decision is a rational or emotional one, a peer driven response, or whether they are courting the consequences of a new choice).

Actors have positions in an Action Situation in the way a sports team has a position of play, such as goal keeper, that can be taken on by various people on various occasions. These positions have particular roles to perform and their actions are determined by the rules-in-use governing the level of society in which they are operating. Positions may be ascribed or assumed, such as when an enthusiastic peer assumes responsibility for teacher-ascribed care of poultry when the nominated student moves out of position. Action Situations have more than one Actor. Garden sessions in this case study have included Garden Specialists, classroom teachers, trainee teachers, a researcher,

volunteers and their preschool children, and a groundskeeper. The individuals who are these Actors influence the Action Situation and each other's choices with it. The introduction of Structuration Links Model concepts also enables theorising of interaction with Actors no longer present in the garden through the Consequence PIOT of their actions.

The internal structure of an Action Arena (Figure 6.2) shows Actors in their positions undertaking actions as part of interactions with others in an Action Situation. The Action Situation is a dynamic context of information and control, in which a range of potential outcomes are being enabled with different net costs and benefits. Influencing engagement with the dynamic of the Action Situation, there is the internal dynamic of the Actor. Figure 6.3 depicts communication factors considered important in this influence (Ostrom, 2005, p.108). Sewell's axioms of change can be modelled as influences on the expectations, perceptions and other factors influenced by the Actor's history. These influences are the valuable collective experiences that enable change.

The reflexive nature of Structuration Theory has a particular effect on understanding potentials forming within Action Arenas.

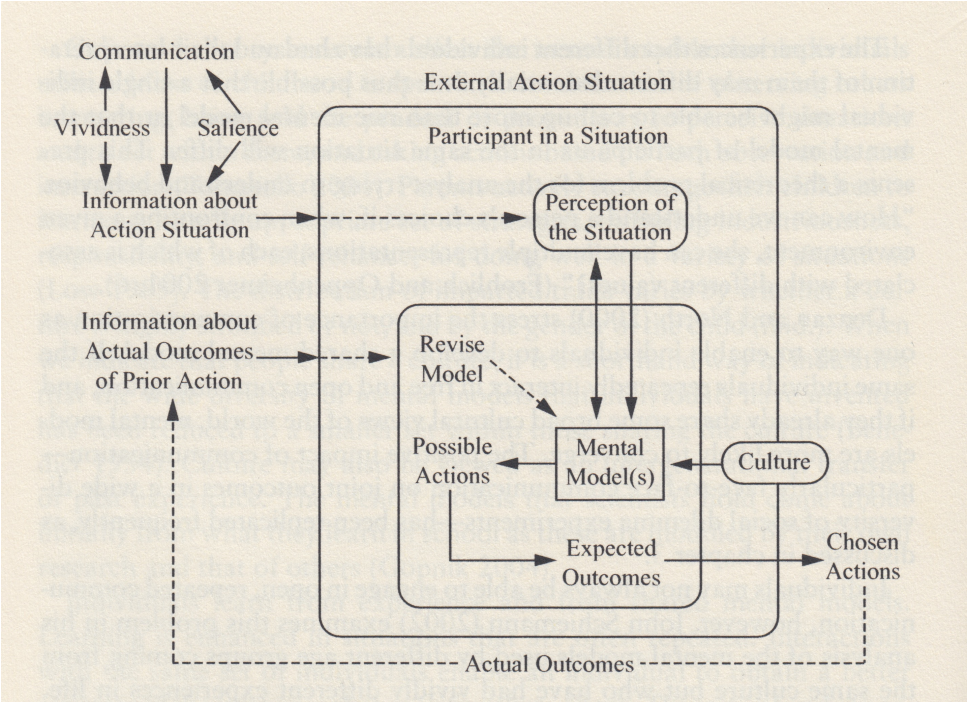


Figure 6.3 Communication factors influencing information available to the Actor within an Action Situation (Ostrom, 2005, p.108).

As a result of the reflexive nature of Structuration Theory, the potential of actions and interactions can only truly be assessed at a point where their outcome is known. Somewhat like Schrödinger's cat (Brown, 1986), the potential of actions within an interaction and, subsequently, interactions within an Action Situation, can only be assessed based on the net effect of their outcomes. Unlike Schrödinger's cat, which as best we know could only be dead or alive, there is a range of possible states between the best and worst of these nested activity potentials.

Continuing the cat metaphor, it is only when the Action Situation box is opened through a reflexive process that the range of potentials can be known. The importance of unintended outcomes in this model lies in this moment of revelation; rather than being able to speculate on the probability of the metaphorical box containing a live or dead cat, in the case of garden physical activity potentials one might expect to discover any number of unintended outcome potentials being revealed across a human development time course. Imperfect Actor information and action-outcome linkages interrupt the possibility of probabilistic speculation because of the absence of a momentary understanding of physical activity potentials.

From a reflexive position, the potential of a physical action to have a health outcome is related to the opportunities that exist at the conclusion of an interaction or Action Situation. Ostrom described this impact of imperfect information on the operation of the IAD framework (Ostrom, 2005, p.50) as adding complexity to an analysis, especially in the sequential linkage of Action Arenas. The ReInterplay Model focuses on the potential of these action-outcome linkages, as it must address the on-going assumption of imperfect information inherent in Structuration Theory's reflexivity.

The ReInterplay Model assumes that where potential is unchanged, repetition of an Action Situation in an institutional situation will produce unchanged outcomes. Where potential is changed however, the Action Situation will produce changed outcomes. From this perspective, action requires interaction and Action Situations to have health outcomes; that is to say health outcomes are social. Changing actions and interaction potentials changes health outcomes. Otherwise stated, with regard to the ReInterplay Model, to change health outcomes requires social change through change to actions and action potentials. Action of itself has a physiological expression, however it is

interactions and Action Situations understood reflexively that reveal the full extent of health outcomes.

In a lay description it is sufficient to say the health outcomes of physical activity are social. They are related to what a person does, how they think back on what they have done and what potential exists in the setting for the action to be related to health.

Outcomes and Evaluative Criteria

Within the IAD framework, Outcomes are conceptualised as a form of relative utility. The IAD framework was developed over years in laboratory situations based on the self-interest assumptions of Game Theory. Consequently, outcomes were often captured in a simple numeric expression such as a dollar value. Ostrom's explanation contains warnings about the difficulty of attributing outcomes in field studies where the decisions are driven by a complex of gains and imperfect knowledge (Ostrom, 2005, p.112).

Within the IAD framework the potential outcome of an Action Situation, when not numerically determined, can be estimated from three components:

(1) the physical results obtained as a result of a chain of actions by participants,

(2) the material rewards or costs assigned to action and results by payoff rules, and

(3) the valuation placed on the combination of the first and second components by the participants (Ostrom, 2005, p.43).

Non-numerical measures of physical activity, those that include an activity's purpose (such as privileges of social inclusion, transmission of school culture, pleasure from a session outside the classroom), are essential to evaluating physical activity as a Health Promotion outcome. The multi-dimensional nature of Ostrom's three components is translated into the potential outcomes of the ReInterplay Model as an effect of the multi-dimensional nature of the PIOTs from the Linkage Model. These purpose-related outcomes of physical activity are rendered in the underlying codes of the school setting and enacted through its interactions.

Outcome Criteria are used by participants to make judgements in Action Situations about the options of their Potential Outcomes. There are a myriad of criteria; Ostrom (2005) singles out a short list, outlined in Figure 6.4 below. This is an area of the IAD framework that requires development from a Health Promotion perspective. Observe the relationship between elements in Figure 6.2. In the IAD framework, Evaluation Criteria do not arise from within the Action Situation and there is no mechanism by which these criteria might change while the interaction is in play. This relationship seems to run counter to the principles of empowerment and has implications for the understanding of subjectivity, even agency, from a Structuration Theory perspective. In its current form Evaluation Criteria are imposed from an external operation.

1. Economic efficiency criteria: allocation or reallocation of resources, such as whether garden sessions could be conducted with a smaller budget.
2. Equity criteria: judge just return or reward for equal participation or access to enable equal participation, such as whether rewards of the garden are equally available and the effort to secure rewards is borne equally among the group
3. Adaptability criteria: judge the development of responsiveness, resilience or learning over time, such as whether the social agenda has changed in the way hoped for at the commencement of the garden program
4. Accountability criteria: judge whether the expectations of significant others are being met by the outcomes, such as whether parents are satisfied that time in the garden and kitchen sessions is supporting academic development
5. Morality criteria: a particular accountability criteria, as would be Conformance-to-the-Health-Promotion-ethic criteria, such as whether the community voice was being accepted in matters of Health, living conditions and well-being.
6. Trade-off criteria: judge the consequential or compensatory responses the Outcome of an interaction makes necessary, such as whether measures to ensure sustainability of the program enable it to continue to meet program objectives.

Figure 6.4 Short list of criteria commonly applied by Actors to evaluate potential outcomes (Ostrom, 2005).

From a Health Promotion perspective, the process of choosing Evaluation Criteria is as important as the criteria eventually chosen. This is particularly the case if there is a

suggestion criteria are being imposed from other levels of an institution or not being adopted locally by the community. The Evaluation Criteria will be influenced by the fundamental elements of physical activity from a Health Promotion perspective, including the sanctity of physical autonomy, recognition of unintended consequences, and the normalisation of biophysical diversity. There also is evidence from this case study of the possibility of tensions, even with the principles of equity and social justice. For example; volunteers in the garden program rationally asserted their rejection of equity outcomes from the program and claimed that inequitable benefit to a limited number of individuals was acceptable. It appears these volunteers were applying evaluation criteria promoting the development of social leadership ahead of social justice. This is a reminder that modelling the process of social structuring is not a process of immediately conjuring an altruistic utopia but of (first) creating healthier settings.

Exogenous Factors

There are three categories of exogenous factors in the IAD framework (Ostrom, 2005): Biophysical and Material Resources; Attributes of the Community; and Rules. Explanation of each of these will be addressed with examples from the case study.

Biophysical and Material Resources

In the IAD framework, biophysical and material conditions determine possible actions, outcomes, their linkages and the information sets of the Actors. Across the three case study gardens there was sufficient variation in geography, soil types, weather patterns, tools and infrastructure, social networks, regulating rules and practices, community involvement and farm-life experience to differentiate the sites. The influence the world has on the action occurring within it is a combination of the dependencies of the particular action and the 'rightness of fit' of the physical conditions. Biophysical and material conditions are not just determinants of action however; potential outcomes of interactions in specific locations differ due to them and change possibilities remain even when they are static. The child who was aghast at the implications of nearby crop dusting on the biodiversity of the garden has different potential outcomes from the conditions than the unaware consumer of the produce purchased from a local co-op.

Attributes of the Community

The attributes of a community are exogenous factors that are not immutable. They include community culture, experience and capabilities. The attributes of a community include its size and composition, generally accepted behaviours, the values expressed, a shared perspective, and the extent of their interrelatedness. Attributes of their experience include their history acting as a community, the level of common understanding and comprehension, and their disposition to, and previous experience of, external rules. The capacities to trust and use language, especially a vernacular in which to teach children, are attributes that reduce the cost of devising and sustaining effective rules. Structuration forces are recognisable in these factors. Change in attributes of a school community may result from renewal or migration.

The case study is rich with examples of the attributes of the school communities. These communities were expressing a pre-garden program culture in their decision to develop gardens in addition to the culture developed in the school as a result of the program. The data set records a subset of their particular experiences and capabilities; the successful establishment of these programs is a testament to existing capabilities and the program sustainability to their on-going development. Schools noted the specific effect the garden program had in attracting a volunteer workforce from within the school community and in the power of the garden to attract diverse families to the school.

Rules

Rules are a highly significant element of the IAD framework and the essential element for level shift strategies. Rules are the

*shared prescriptions (must, must not, or may) that are mutually understood and predictably enforced in particular situations by agents responsible for monitoring conduct and for imposing sanctions (*Ostrom, 2005, p.187).

Rules nest and the IAD framework represents rules within rules within still further rules. This lack of independence means rule changes at one level have consequences at other levels; incentives and disincentives alter with the changed configuration of the nested rules. Nowhere in the garden program is this more evident than in the complex

funding program rules the schools have had to navigate in order to keep their garden programs viable.

Levels in the IAD framework are created by the clustered sets of rules made within them and which they impose on adjacent levels. Effecting change in institutionalised interactions may involve addressing a deeper source of rules that govern the interactions of interest. An example of this in the garden programs is the influence of rules being applied by Federal interests on the funding allocations of the school system, such as was occurring in anticipation of changes under the Gonski report (http://www.igiveagonski.com.au/whats_gonski). This kind of influence is referred to as a level shifting strategy, without which a multi-level framework offers no greater understanding than a single level model. The ReInterplay Model has resumed focus on the multi-level IAD framework to give school communities access to these strategies for understanding what is involved in the promotion of health in their own setting.

Rules set at the deepest of levels are stable. Biophysical rules are treated as essentially beyond our power to change; changes through actions are merely compensatory. At each successive level up towards the operational level, rules become less constant, more able to be fashioned, altered, corrupted or partially applied. Participants enforce rules on themselves with their own internal and external incentives and disincentives, many translated across from the primary institutions of family, religion or law.

A related concept is rules-in-use. These are a socialized code participants develop in accordance with an existing rule-ordered system of behaviour. Rules-in-use are the group's 'dos and don'ts' learned through practice. Gardening practices, as well researched as they may be, are fraught with Rules in use about all aspects of plant care. Rules-in-use might not be documented and if documented rules exist, rules-in-use may contravene the written form. Such is the case when operational strategies emerge from the routines, decisions or behaviours that maximise benefit within an Action Situation. These strategies cannot change the influence of rules from other levels however they can modulate potentials and outcomes. The timing of kitchen sessions to coincide with the lunch break is an example of the emergence of rules-in-use from an operational strategy to comply with but subvert mandatory school break times.

Dynamics of an IAD Interaction

The IAD framework offers a scaffold for Health Promotion relevant theories to hypothesize understandings of physical activity in school settings. However, while the IAD framework models a constant transmission of action potential around a multi-level system, illustrating opportunities for level shifting and new understanding, school settings are more conservative places. Paradoxically, previous action has simultaneously strengthened pre-existing institutional routines as much as enabled restructuring of the institution with each repeated circuit. Decisions made in the establishment of the garden programs have an enduring influence on the potential actions of present program delivery.

The dynamic of the elements in the IAD framework and the recognition of possibilities revealed through action on different levels needs to be tempered by an equal appreciation of the weight and inertia that social structures exert (Sewell, 1992). A balancing of the partially rational decisions, incomplete information and imperfect autonomy of agents within the setting needs consideration. There is an inherent resistance to rapid change in institutions (Sewell, 1992). It can be incomprehensible to some how difficult it is to have a piece of fruit included in a school lunchbox daily for consumption in class. Structuration and the newly added structuration-related concepts of PIOTs and Structuration Links contribute to an explanation of the weight, inertia and realism of effecting change in the school setting. The history of interactions continues to exert a force on the present action through codes rendered in the structuring of the setting.

Structuration Theory

Structuration, as understood through the ReInterplay Model, is a concept entrenched in the outcomes, fabric and processes of institutional development.

In Structuration Theory, structure and agency are resolved as a structure: agency duality "conceptualised as interdependent and mutually reinforcing" (Rütten & Gelius, 2011, p.953). The theory positions people as knowledgeable agents and structure as the rules and resources produced and reproduced by agentic activity.

Structuration is a process that is understood through the study of actions of daily life and their reproduction of social practices. It is an explanation of how unconscious, unacknowledged and unintended actions translate to form systematic social institutions. Importantly for Health Promotion, Structuration Theory relieves the burden of an assumed intelligent design of society without eliminating the possibility of future change and engineering.

Structure is conceptualised as the rules and resources in a situation. Those resources are associated with allocative and authoritative power. Allocative power is the capacity to dominate material resources drawn from the biophysical world (Giddens, 1984, p.373). Authoritative power, by contrast, is the ability to harness the activity of other Actors (Giddens, 1984, p.373). Rules, although given extensive conceptual discussion in Structuration Theory (Giddens, 1984, pp.17-26), can be thought of as "generalizable procedures in the reproduction of social life" (Rütten & Gelius, 2011, p.954). They are of two types. The first are intangible agreements representing "informal conventions that govern everyday life" (Rütten & Gelius, 2011, p.954). The second are tangible rules that are communicated in "formal regulations" (Rütten & Gelius, 2011, p.954). From this description, the relationship of structuration to the interests of institutional settings begins to emerge. Similarities are evident between resources and exogenous variables of the IAD framework and within the two concepts of rules and rules-in-use.

Structuration Theory assumes the knowledge of agents is bounded by unconscious motivations, unacknowledged conditions and unintended (latent) consequences (Giddens, 1984, p.282). Actions are thought to commonly proceed without intention formed from judgement, occurring in unexamined contexts with unpremeditated consequences, only later to become moments for consideration. People do things routinely without prior thought to their actions; motivations might remain in the purview of third parties with a historical perspective. Many of the actions necessary in establishing the garden programs exemplify these attributes: the motivations given by the participants now are indistinguishable from those that may have driven the actions undertaken in the establishment of the program. Those reported in the case study now are not necessarily any more or less truthful regarding the unconscious, unacknowledged and unintended actions of the time.

Giddens positions routine as the dominant form of daily life and as essential in comprehending the structure:agency duality (Giddens, 1984, p.283). Routine agentic actions stabilise and strengthen structures of society, giving them integrity in time and space. Structuration theory positions institutional structures as unfixed; they are produced and reproduced in perpetuity by the activities of daily life. Their continued existence is dependent on continued agency, resources and rules. Because institutional development is not characterised by reasoned motivated intention, motivated intention can represent a threat to social stability. If social health is preserved through the reproduction of action and minimisation of change to action potentials (as previously suggested), from this perspective, the preservation of social health would appear to be a function of the agent reflexively creating structure. This would *not* be an argument in favour of the intervention approach to increase physical activity in schools.

Time boundaries are central considerations in Structuration Theory. They are especially important in considering the potential health outcomes of action. Institutional structures continue a history; continuance necessarily involves on-going structuration over time. The time dimension, no matter how ubiquitous, should not be overlooked. Moments of structure are inextricably bound to the agency they are constraining or enabling, constrained by or enabled by, from the past, present or future. One is reminded of this constantly when studying the physical activity of developing children in school settings generations have passed through and identified with as their own.

Giddens speaks of needing to represent structure as the 'underlying codes' that are inferred from 'surface manifestations' (Giddens, 1984, p.16) in social systems and the inherent continuance of a time dimension. If interaction cycling through the elements of IAD framework levels represents structuration's 'surface manifestations', it is possible to use the Structuration Links Model to represent structuration's 'underlying codes'.

Structuration Links as Underlying Codes

Interpreting the Structuration Links Model as the 'underlying codes' spoken of by Giddens (Giddens, 2004, p.) enables the ReInterplay Model to represent actions and reflexive cognitions of Actors as the observable structuring of settings through the unique subjective conceptual concepts of the PIOTs. The ReInterplay Model envisions each interaction in the school setting cycling through the elements of the IAD

framework (the surface manifestation of structuration) generating link unit outcomes. These single link units join with others created by interactions in the same setting space, creating stitches of a moldable, self-supporting, social fabric. With time and repetition, the structural integrity of the consolidating chain mail becomes coded into the social fabric of the setting. The structuration links, the units they comprise and ultimately the institutions they are formed into are constituted entirely of the duality of agency, structure (meaning rules and resources), time and space captured through the physical activities of people in a setting, a community and a society.

By regarding Giddens' underlying codes in this way, interactions over the ages influence and are chronically influenced by the interactions that are occurring today. In the ReInterplay Model, the past remains relevant to the agency of people interacting in the present through the repetition of routines and the propensity to think reflexively on rationalities. So it is that the 'underlying code' influences present interactions while the 'surface manifestations' enact them. The physical activity of the food garden programs in these schools simultaneously code and manifest on these two levels. Understanding the relationship between the levels is a valuable return from studying the physical activity of daily living programs from the Health Promotion position of subjective purpose.

Theory of Structure

Sewell (1992) re-theorised Giddens Structuration Theory in an attempt to consider structure in a way that better enables change and returns the human agency of social Actors to the forefront. To Sewell (1992), the ordinary operation of structure must retain the capability of transformation, a view in keeping with a Health Promotion perspective. To this end, he proposed five 'axioms' for change, each related to either rules or resources, the two components of structure from Structuration Theory. The axioms are presented in Figure 6.5.

1. Transposability of Schemas: Agents apply seemingly novel solutions they have learned in other places, situations or institutions. Rules can be applied to different situations enabling new outcomes and change.
2. Multiplicity of Structures: Agents interact with society's numerous structures and thus potentiate transposibility because structures – or rule:resource combinations – are not homogenous. Even within a place or situation several combinations may be exerting influence.
3. Unpredictability of Resources Accumulation: Transposed responses produce uncertain resource outcomes, altering an agent's inclination to apply rules. The changes to rules and/or resources result in a change in structure.
4. Polysemy of Resources: The meaning of resources is subjectively and differently determined by agents and by different agents. Different value is allocated to resources.
5. Intersection of Structures: Social structures are not discrete but overlap and the overlap necessitates interpretation by agents.

Figure 6.5 Sewell's (1992) five axioms proposed as a conceptual vocabulary for discussing structural change.

With these axioms, Sewell (1992) created a vision of institutions as more open systems perpetually undergoing the process of structural change as a result of actions, intellectual and experiential capital, and agency of people interacting in their daily lives. The axioms help model and identify the underlying influences of agents' rationality in change decisions. They provide categorical guidance for understanding barriers to, and facilitators of, progress in a change agenda. Personal history and experience are introduced as legitimate influences on an agent's rationality, and, with them, an accumulating and continuous time dimension, one that is often missing in simple staged change models (Prochaska, Redding, & Evers, 2002). The possibilities of structural change represented by these axioms are unrestricted in that they may be unmotivated, have unpredictable outcomes and be a conservative, progressive or adaptive response to change in other settings, levels or social institutions.

In the ReInterplay Model, the axioms are omnipresent messages, influences and filters on agents and their interactions. These axioms represent children playing, volunteers translating skills and attitudes from other places, people projecting solutions from their domestic relationships. They are the outreach of staff to the community, the influence of national programs colliding with local needs, the introduction of new curriculum and the growing dependence on the internet as a medium of learning. The axioms are change opportunities related to understanding of the limits of the planet's food production capabilities, the re-evaluation of leisure time, a growing appreciation of the uncertainty of a seed crop and the love of chickens where there used to be poultry.

The axioms are essential to the mechanism that transitions the 'surface manifestations' of interactions into 'underlying code'. Their function is to provide linkage between seemingly isolated interactions and permit the generation of resources from the deeper levels based on subjective value and prior learning. The axioms create the possibility of learning from experience, error from assumption, resources from understanding, power, meaning, restraint, ethical development or transgression and the interpretive thoughts that characterise rationality. They play a central role in relating unplanned action, reflexive thought and unintended consequence in structuration. In the ReInterplay model, rather than being textual side notes, the axioms are the fundamentals of reflexive cognition and therefore ubiquitous forces at play within every interaction.

Ottawa Charter

A relationship to the Ottawa Charter is an essential aspect of any social theory model purporting to be for Health Promotion. In the ReInterplay Model, the pledges of the Ottawa Charter are positioned as ethical principles influencing the patterns of interaction and evaluation of their outcomes. In a chaotic situation, these ethical principles may be completely absent or foreign; there are no *a priori* assumptions that people are aware of, motivated or constrained by them. Depending on the situation in which the ReInterplay Model will be applied, these principles may, for example, be in need of reintroduction as motivating values in community attributes, formalisation as evaluation criteria or operationalization as rules-in-use having greater influence on people's interactions. In contrast to the Health Promotion actions and strategies, modelling the pledges of the Ottawa Charter provides the opportunity to theorise *Health*

in All Policy as a facet of daily interactions occurring at all levels in the process of institutional development. The pledges of the Ottawa Charter (WHO, 1986) were reproduced in Text Box 4.3. The strategies and actions of the Ottawa Charter are reproduced in Text Box 6.1.

Text Box 6.1 Strategies and Actions of the Ottawa Charter (WHO, 1986)

Strategies

- Enable
- Mediate
- Advocate

Actions

- Build healthy public policy
- Reorient health services
- Create supportive environments
- Develop personal skills
- Strengthen community action

Introducing the Ottawa pledges into the ReInterplay Model positions them as constraints on the outcomes of interactions and theoretical hypotheses. Unconstrained interactions and their outcomes will continue to occur and the model needs to retain this facility for imperfect influence on outcomes in order to maintain the ability to model societies in chaotic health conditions. Augmenting the opportunities for constraint of interaction by the pledges and diminishing the frequency of unconstrained outcomes becomes the objective of progressive circuits of interaction to effect the manifestation of Health Promotion.

The ReInterplay Model focuses on three locations of restraint exerted by the Ottawa pledges on the possibilities of an axiom enhanced IAD framework model: action-outcome linkages, evaluative criteria and the origin of rules.

Action-outcome linkages are the most fundamental location of constraint by the pledges (Ostrom, 2005, p.105), being constraint by agency itself. It occurs in the internal mental processes of agents reflexively monitoring and making intentional decisions or

judgments. These agentic acts result in the intended and unintended outcomes of the interactions. This image of constraint is in keeping with the conceptualization of the Ottawa Charter as an ethic that translates for individual behaviour.

Evaluative criteria are a location where the pledges are able to constrain patterns of interaction and outcomes. This constraint location positions the pledges as a feature in the judgment of social process, the conceptualization most Health Promotion professionals would initially hold, given the origins and history of the charter.

Rules are the final location where constraint can be exerted by the pledges. Rules exert influence between levels, regulating the multi-level form of the institution. The pledges restrain two sites, where rules originate and where they are applied. The first of these is restricting outcomes of interactions within a single level, dissuading level-change influences. The second is facilitating outcomes transitioning adjoining levels, granting access to level-change influence. Constraint of this kind positions the pledges as change capable in an institution's operations.

In these three ways, constraint from the Ottawa Charter can be seen within the model as a combination of personal, social and institutional locations.

6.2.2 Uniting the Components

The fundamental position of the ReInterplay Model, a theoretical proposition for Health Promotion settings, is that Health Promotion is achieved by people acting in their daily lives, with or without awareness, intentionally or unintentionally, constrained in the process of structuration by the pledges of the Ottawa Charter. Modelling an optimal environment would mean the pledges influenced the elements sufficiently often with sufficient potency to optimize health outcomes. Potential for Health Promotion would be evident where the pledges are not sufficiently in evidence in the process of structuration or across interactions at different institutional levels. For Health Promotion change to occur, the ReInterplay Model would facilitate specific interactions to provoke the influence of the pledges in cycling through the elements. That is, the pledges would operate as a core part of the structuration process in institutional development.

The ReInterplay Model conceptualizes Health Promotion change programs per se as temporary. They are considered to be remedial action or short-term strategic

intervention to facilitate people at any level to stimulate structuration in the interests of health. The responsibility of the Health Promotion profession is to advocate, mediate and enable the structuring to achieve those health interests, directing initial actions towards public policy, health services, settings, skills and community action. It is also the responsibility of the profession to normalize the pledges in social structuration in order to maximize interactions positively influenced by the pledges and health, which in turn may minimize awareness and intentionality. While making change is temporary, normalizing a Health Promotion ethic in institutional interactions and structures aims to be permanent. Approaches such as Health in All Policy (Ministry of Social Affairs and Health Finland, 2013) can be considered to be one example of this, operating as temporary processes to bolster the early stages of this normalization.

This is a plethora of responsibilities, strategies and actions. The person with first-person perspective and memory of previous actions and results is best positioned to gain an understanding of the situation on all levels and introduce new interactions to drive change scenarios. That is Health Promotion's commitment to community participation.

6.3 The ReInterplay Model

What follows in this section is a conceptual description of the ReInterplay Model. The purpose of this model is to engage non-academic professional and school community members to develop an understanding of the processes of institutional structuring in their school and ultimately use this knowledge to change the structure of their school to promote health. The model is not the replication of a concrete school setting; it is an imagined place representing the abstract processes and theoretical concepts that develop the social institution of the school. Sadly, it cannot be produced as a virtual environment at this time. It is depicted here in the line drawings and paragraphs of text of the framework and component theories related in the previous section.

6.3.1 Bringing the ReInterplay Model to Mind

The short cut to seeing the ReInterplay Model is to imagine a computer generated game environment with four levels. The view changes between first and third person perspectives at the will of the model user and users can actively introduce details to the predetermined element layout. The first view is a blown apart floor plan showing the

layout of the levels. This is imagined like a shopping centre map (Figure 6.6). Drawing on this familiar infographic image is key in communicating across audiences. The shopping centre map is a metaphor that easily conforms to the hierarchical understanding people have of the institution schools, taking the form of local schools, district education offices, state departments, federal education portfolios. The shopping centre metaphor incorporates the capacity for reinvention through enduring but impermanent change to shop fittings in dedicated zones (retail, food court, staging areas), flexible changes like pop up enterprises within the space, and the kind of active human churn evident when standing silent observing within one of these buildings. This metaphor is a malleable bridge between real and imagined lived experiences and theoretical relationships.

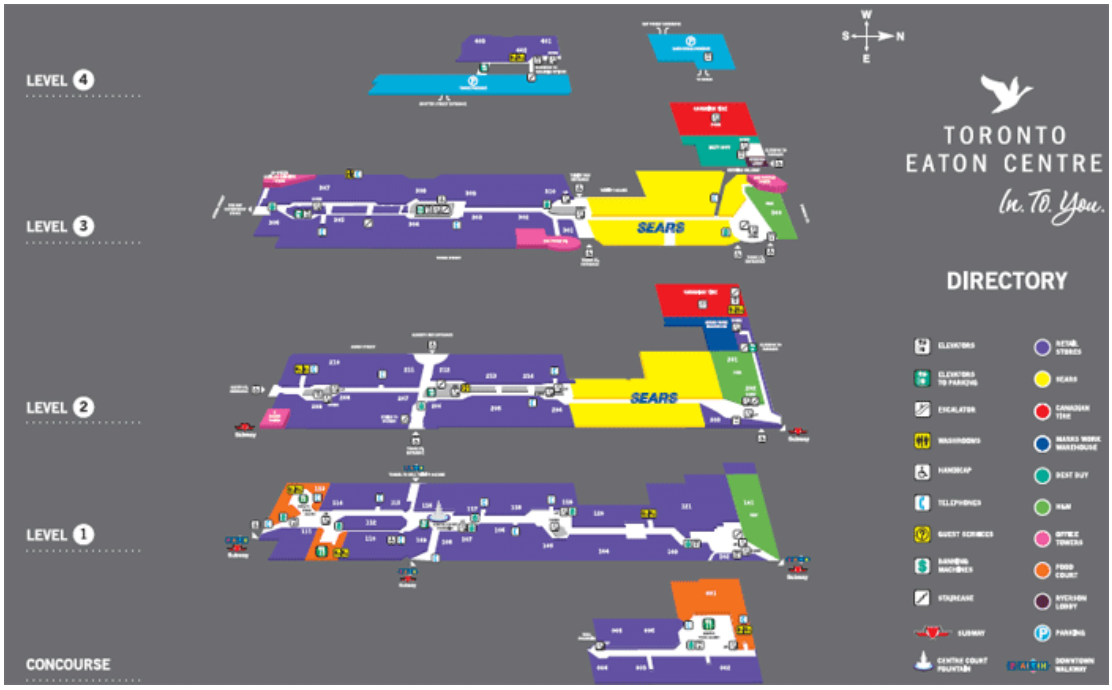


Figure 6.6 A shopping centre metaphor to illustrate levels in the ReInterplay Model (http://www.searchingtoronto.com/toronto-eaton-centre/)

The four levels of the ReInterplay Model begin with an identical floor plan that corresponds to the elements and relationships of the IAD framework (Figure 6.2). The participative engagement and design process of the community customise the floor

plans. To begin with, irrespective of the level, the same elements are related in the same order in the cycle, much as one might imagine a shopping complex before specific enterprises commence their fit out. With participative action, the emphasis on, or importance of, individual elements may change across the levels. In the shopping centre metaphor this might be thought of as recognisable zones across the levels but themed enterprises. An individual can quickly acquire understanding of the elements and how they relate in the cycle in the way that one can sense the close relationship between restrooms and café enterprises in a shopping centre. Learning the nuanced differences between levels and leveraging these to achieve particular outcomes would require more skill and likely occur more slowly, however existing lay understanding of social processes and wielding of power in schools should not be underestimated.

Four levels of the floor plans of Figure 6.6 collectively comprise a four-storey shopping centre that can be imagined as looking like the one shown below in Figure 6.7. To preserve the layout of the IAD framework, the imagining of this building must include its construction at the base of an escarpment, allowing a street level access via the top floor. The levels of the building descend the slope to the foundations of the building, representing the biophysical world. In the school context these descending levels represent the underpinning of the local school on the top level by the district, state and federal levels of control. Relating the building to the site in this way preserves the conceptualisation of progressively deeper levels, a characteristic of the IAD framework observable in Figure 6.2.

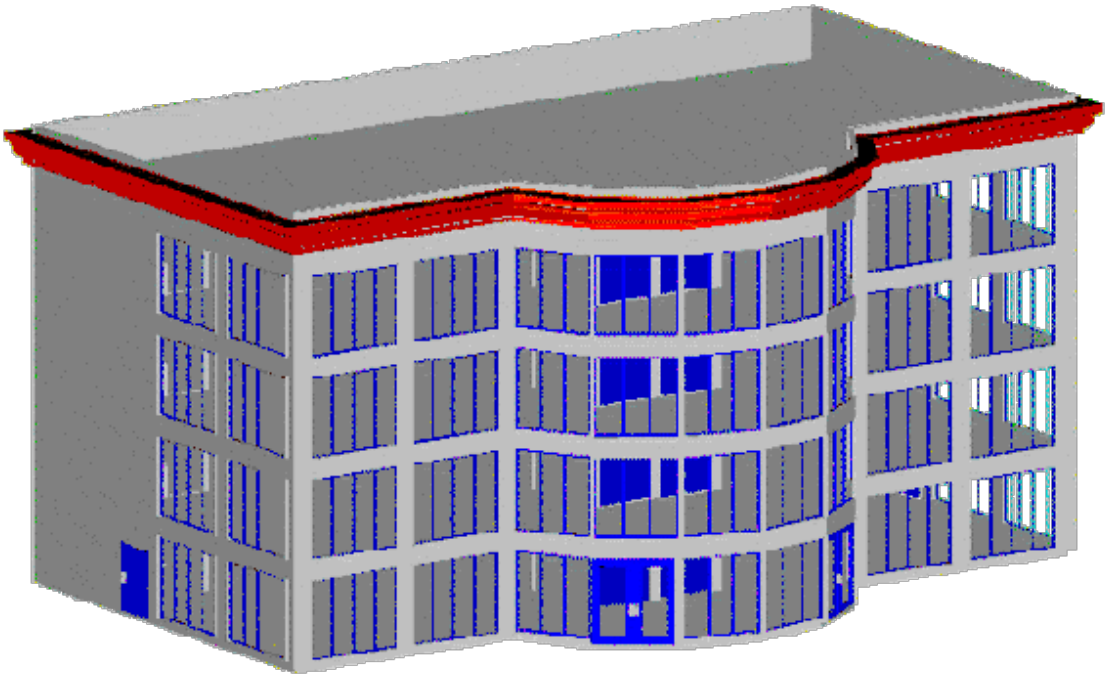


Figure 6.7 A visual prompt representing the institutional setting of the school as a four-storey building (http://www.dscohn.com/AU/web_class/sample.htm)

A staircase at the end of the building, like the one in Figure 6.8 joins the different levels. This provides a mechanism for influence to pass to and from local schools from these deeper levels.

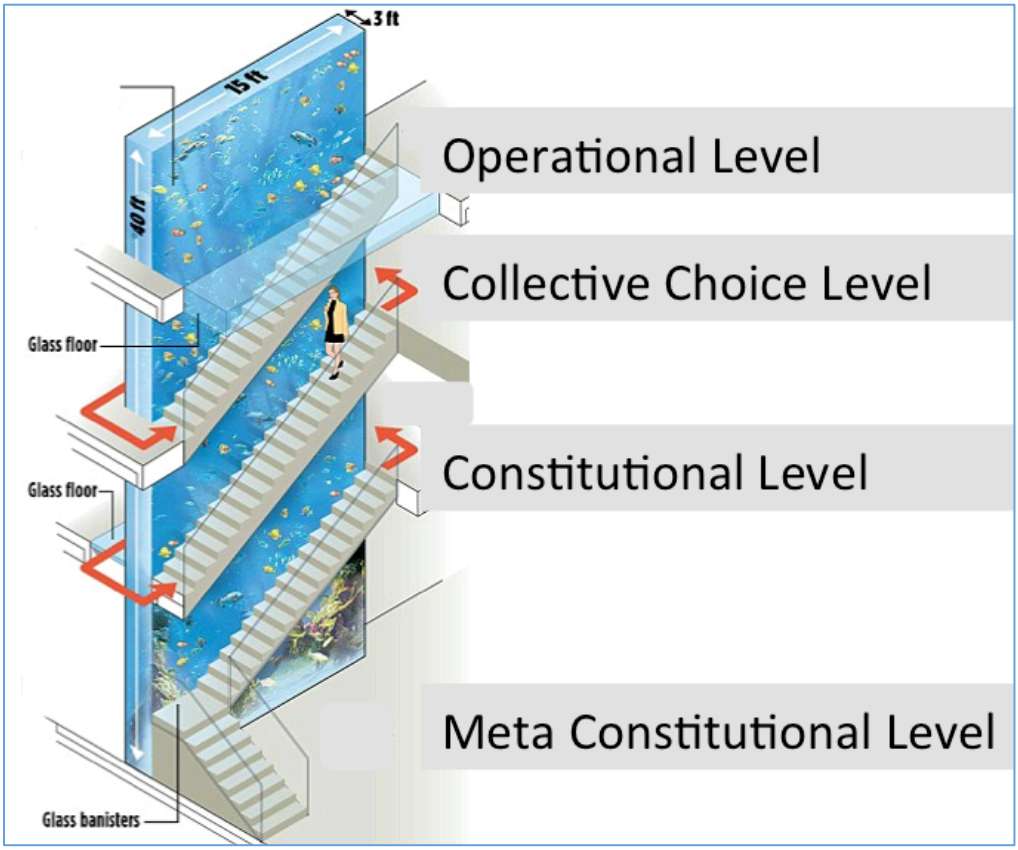


Figure 6.8 A visual metaphor to create linkage between levels of the ReInterplay Model (http://i.dailymail.co.uk/i/pix/2012/02/18/article-0-11CD76CA000005DC-669_306x581.jpg)

The staircase provides metaphorical access to other levels. The model shows how each level is unique but collectively that they are connected parts of the same institution. It is through this staircase that rules, resources and people of influence pass from one level to the next. The top level of the model can be considered to be the Operational level of the IAD framework and representing the local school. The levels descend through the Collective Choice levels, Constitutional and Meta-Constitutional levels of the biophysical world.

This ReInterplay Model shopping centre is not made of cement and reinforcing steel. In keeping with Giddens' stated intention it has no skeletal framework of this kind. It is constructed purely of the 'chain mail' of Structuration Link units, laid down in interlinked layers to form the material of the walls, ceilings, windows and floors. New links are being created and hooked into the existing fabric as the people interact in this and other levels. The individual links of the fabric are being made and re-made

perpetually by the manifest cycles of the elements and this fuses the links into a self-supporting material. The building continues to exist because the interactions manifest within it form and maintain this underlying socially-engineered chain mail material. Without continuance of these interactions, the institution begins to perish, as did Australia's abandoned community school initiative of the late 20th century, as do the health outcomes of the physical activity of that setting.

6.3.2 Cycles of Interaction

Action Arena

The entrance level to the model, the Operational level, is on the top level of our virtual building and reflects the Action Arena of the IAD framework layout. This zone provides an important location for social exchange and each school community will determine whether this conforms to a physical space or social membership in their own application of the model. In the parlance of the IAD framework, entry is made into the Action Arena where Participants are placed into Action Situations. Ostrom describes these people as being "faced with a set of potential actions that jointly produce outcomes." (Ostrom, 2005, p.32). Within the ReInterplay Model the pledges of the Ottawa Charter would be symbolically reflected in the fixtures, furnishings and art works. The school community applying this model introduce their own symbolic devices to represent their experiences of the setting and create local meaning. The Action Arena is a political space. The features in this space may or may not communicate the ethic of Health Promotion in that they may or may not represent in their design or detail a counter force to harmful products. Identifying the interactions in this space is a major task for a school applying this model.

The symbols of the Action Arena can be imagined as the tools, objects, wisdom and the inspirational messages that will influence the interactions of this setting. For this case study the Action Arena of the first level might be the foyer of a school or the Parents and Citizens meeting in the school staff room or an informal gathering after morning assembly or a fictional combination of all these occasions.

This thesis describes the model representing a school; however, the ReInterplay Model could be applied in a number of different multi-levelled social contexts. The model

could equally be the reception of an inner city hospital or a town square in a chaotic war-torn setting. In such instances the Action Arena area the community design may be more barren. Objects might be bolted down, chairs and fittings alike, or the zone may be represented as a very bleak and broken place. In such scenarios it would be more challenging to find symbolic representation of the Ottawa Charter pledges, however their initial absence is equally symbolic of the health outcomes of interactions from that Action Arena. There are no a priori assumptions of pre-existing Health Promotion in Action Arenas of the ReInterplay Model. If a community can find any symbols in situ, that is evidence of their achievement to date.

Patterns of Interaction and Outcomes

If we were to continue our third person virtual tour of the model, at the eastern end of each level is a partitioned off zone were Evaluation Criteria are introduced. It is adjacent to two elemental zones, Patterns of Interaction and Outcomes. This is the place where action and consequence occur. In this case study it was the action and consequence of the garden that was the focus of investigation. In another school study the community might continue to consider their school in this narrow partitive way or they might choose to look at their school as a whole. The zones of Patterns of Interaction and Outcomes continue to be under the influence of any Health Promotion symbols that may have been acting on the participants in the Action Arena; still others might be introduced, for example, as the intended consequences of Sewell's third axiom unpredictability of resources. The interaction and outcomes zones are also in proximity to the evaluation zone; they are likely to be open to axiomatic influence.

In the Patterns of Interaction zone moments of choice are created ahead of any commitment to bringing about the action of a cycle. The separation of the Action Arena from the Pattern of Interaction zone allows participants to find themselves in Action Situations and elect not to act and to decide to stay action. In the case study this kind of rehearsal appeared in the moderating theme of normative social discourse in the school. This behaviour can be represented in the model; participants may enter the Patterns of Interaction zone to consider or rehearse action they might take and then wander back to the foyer to wait, perhaps until the situation changes. In moments of forced choice,

Actors leave the foyer compelled to choose and act or simply to act without precognition.

Once action occurs, it sets off a chain of events in the Action Arenas of other levels or in a series of linked cycles around the present level that must run their course. In the context of this study, an action at school level that enacts a departmental policy strengthens authority of the rule; this minute instance of strengthening of authority might be the full extent of observable change from the chain of events. The school community at play with the shopping centre metaphor might introduce electronic transactions with the centre management to represent strengthening authority in this way; their decision only has to be sensible to them as a group.

Once action is initiated there is no option but for it to proceed (clockwise) to the Outcomes zone, located toward the south- eastern end (lower right quadrant) of each level in the virtual model. The influence of a moment of time is not reversible and so progress through the cycle can only flow onward from the Outcome zone. Having committed an action and interacted, that onward progress cannot stop until the chain of events ends and progress around the cycle returns to focus on the Action Arena back in the foyer again. It is well to remember that the interaction observable in this cycle is a surface manifestation of the model underpinned and influenced by the potentials of the underlying PIOT codes. Just as with a physical object, the strength of the material of construction is determining the function and capacity; established settings may have a greater facility and potentially a greater resistance to change.

A single interaction may cycle and produce outcomes that are expressed in one of three places in the model. Outcomes can influence subsequent cycles of interaction directly, where progression around the cycle changes something within the Action Arena of that level. In the study this might be represented by a growth in the numbers of parents electing to stay and listen to assembly. Interactions can influence indirectly, where progression either changes something in a variable within the Exogenous zone at the other end of the level or proceeds up- or down-stairs to create change on another level. An example might be the changes to school demographics from a sustained series of interactions in the school that brought about the starting of a food garden program.

In addition to these surface manifestations of structuration, every interaction creates an outcome that is coded into the structure of the metaphorical environment. These coded influences are the by-product of the action and its outcome. They impact time- or space-distant from the actions that initiated them. Examples of coded influences coming forward from previous interactions from Physiological, Contingent and Consequent types might be physical strength and skill developed by the children, trust or mistrust in the garden volunteer community, resilient nervousness or lack of confidence from past failure, and access to funding for non-garden purposes from networks established through the food garden program. These are the PIOTs described in the previous chapter. While the interactions are cycling through the zones producing an effect *in* the environment, simultaneously the cycle is also having an effect *on* the environment as a by-product of structuration. This is how the agency, rules and resources are becoming the institutional structure.

Evaluation

In the IAD, Patterns of Interaction and Outcomes are attributed with value from Evaluation Criteria and so it is in the ReInterplay Model. Before following the cycle to explore options of where surface outcomes will manifest in the model, this description of ReInterplay must address the evaluation zone and its influences. The influence of Game Theory in the development of the IAD framework has coloured this aspect in a way that needs to be addressed for the ReInterplay Model to serve Health Promotion purposes. While Game theorists may be content with their control of Evaluation Criteria, it is a practice that breaches the Health Promotion ethic; community members will need to have input into the choice of criteria themselves.

The present discussion is not one of Evaluation Criteria that arise from other levels of the metaphorical building; these are associated with between level regulation and it is expected criteria will be asserted along with rules. It is a discussion of Evaluation Criteria generated to assess interaction outcomes from within a level. In the IAD framework the evaluation zone has direct, one-way connections to the Interaction or Outcome zone; influence flows outward from the evaluation zone only and influence back inward from the cycles appears prohibited. This apparent prohibition, with its single headed arrows representing the relationship between zones, is unacceptable in the

Health Promotion applications of the ReInterplay Model as it counters community and subjectivity ethics of Health Promotion. The importance of this to a Health Promotion perspective became evident during the current study in the process that identified the PIOTs. Multiple unintended rationalisations were revealed to be driving the Evaluation Criteria of garden program participants. In the ReInterplay Model the Evaluation Criteria are unchangeable during a specific interaction cycle but must be amenable to change in subsequent cycles and over time. Accordingly, the ReInterplay Model introduces a communication process that allows interactions within a cycle to have influence on Evaluation Criteria applied in subsequent cycles.

Feedback into the evaluation zone can also arise from different metaphorical buildings entirely, representing Evaluation Criteria asserted from other institutions. These locations represent the cross-institutional influences of Sewell's change axioms (Sewell, 1992). Recognising the influence of these distant evaluation audiences, even through a simple process of determining who they might be, is a powerful insight that application of the ReInterplay Model might produce for a community.

The metaphorical shopping centre tour passes an office running the entire eastern end of the level off-limits to the general public and representing the evaluation zone. There is a vista through the glass panels that constitute the external wall giving a view to other institutional buildings along the escarpment representing the egress of Evaluation Criteria from other institutions. In the office itself there may be an installation of status bars or a trophy case of object icons labelled with titles like "coin", "counts", "health", "NAPLAN score" and some from common influential criteria (Ostrom, 2005, p.104). Not all of the status bars or object icons in that end office are legible or visible from outside. The status bars indicate a positive or negative evaluation is being made about a particular criterion for an interaction playing out on this level.

These status bars represent a judgement of interactions in the school. Like the symbols of Health Promotion in the foyer, they need to originate in the symbolic understanding of the school community and be identified during the customising of the model by the community. In the case study there is evidence of departmental oversight through key indicators like school attendance and, particularly in School Three, on-going garden program evaluation through a Community of Schools committee. Perhaps the

Evaluation Criteria from these groups represent Evaluation Criteria from the Constitutional and Collective Choice Levels.

Exogenous Variables

Two paths exit the Outcomes zone. The first pathway turns straight back into the foyer on this level directly influencing the Action Arena. Changes within the Action Arena observed in this case study was a change in the diversity of participants engaging in previously spontaneous gatherings in the school and the progressive formalisation of those gatherings to become meetings. The second pathway from the Outcomes zone influences the Exogenous zones and potentially, via the staircase, exerts influence over outcomes in other levels. This is the last stop on the virtual tour before needing to take a look into other levels.

The three Exogenous zones – Biophysical World, Rules-in-Use and Community Attributes – are conceptualised in the IAD framework as fixed for the time course of the analysis. While this condition suits the institutional scale application of the ReInterplay Model, it is not as useful where the initial application begins with a community design phase focussed in the Operational level on a scale commensurate with a lived environment or setting. These exogenous variables – especially in the Operational but also in the Collective Choice levels – are significant social locations for setting change. These changes may be temporary such as was witnessed regarding Rules-in-Use during visits from departmental personnel on a school inspection and honoured guests on Parent's day. In any case it is important to maintain a sense of possibility in these zones at the Operational settings level.

Exogenous zones in the Operational level of settings are changed by outcomes, often the 'surface manifestation' cycles of the deeper Collective Choice, Constitutional and Meta-Constitutional levels. One would not say 'readily changed', despite the perceived ease suggested by evaluation reports and intervention protocols, as these changes can take many years of social process and even serendipitous circumstance to bring about. Changes to soil structure and the resultant biodiversity, or changes to enrolment patterns and the resultant social inclusion, or changes to leadership and the follow-on parental engagement, are all significant exogenous setting changes evidenced in the case study from prolonged social action and chanced opportunities. Each has legitimate setting

health implications (Dyment & Bell, 2008; Heim, Bauer, Stang, & Ireland, 2011; Witzling, Wander, & Phillips, 2010). The ReInterplay Model challenges the sense of 'comparative ease' in changing setting Action Situations by highlighting the comparative difficulty of empowering Actors to influence Rules on their immediate level under the influence of other levels.

The Exogenous zones line up along the western end of the level adjacent to the virtual stairwell. They feature in the imagining of the ReInterplay Model as zones imbued with a sense of stability and quality. The symbolic objects of these zones have a scarcity value associated with them. The Exogenous zones have a profound impact on the vibrancy and potency of the foyer inter-activity and the capacity of the level. The sense of potential for choice and judgement of the previous zones is replaced with a sense of limitations, organisational culture and strategic priority and values from stable parameters. In the virtual metaphor these can be either negative, containing symbols of ruined biophysical environments, disappearing people bereft of capability, unpredictable, lawless, disorganisation; or positive, showcasing symbols of the powerful resources of place, community and society. The unabashed objective of developing the ReInterplay Model is to enable communication between the participants of different levels of the institution of schools without assuming imminent change or suggesting that the prerequisites of health are synonymously the prerequisites of health promotion.

6.3.3 Level Shifting

Outcomes arrive in the ReInterplay Model from other levels destined to pass back through the Exogenous zones of the level in which they will finally reside, buffered, screened and selectively influenced by these zones. In the school food garden program context this selection might be the availability of space in a schoolyard, the interest of teachers in a staffroom, the capacity of staff to collaborate on writing a funding application or social disadvantage limitations placed on allocations through that funding program. In the shopping centre metaphor a newfound sense of curiosity emerges as one approaches the extremes of the current level and tries to see to levels below through the aquarium pillar of the staircase, attempting to understand the origins of these rule-derived outcomes, the impact on this level, and their goodness of fit with local

interaction. The staircase allows a watery, reflective view to other levels to simulate the current imperfect state of understanding of the health outcomes of a school as they relate to these very distant social locations on other levels.

In the ReInterplay Model as in the IAD framework, Rules create the separation of levels; therefore the opportunity to access multiple levels is a privileged circumstance. Few school members are made privy to the decision process of school program funding agencies. The objective of using the ReInterplay Model is to engage people acting in any one level to allow them to build an understanding of the influence their actions have on others and the relationship others' actions may have on their daily lives. The metaphor of a shopping centre is introduced to make that action, which stretches across time and space, of a comprehensible scope. To address the phenomenal complexity, the idea is to take one intimate lived experience of their lives- something as small as the health outcomes of their food garden program- and allow understanding of it to build into an understanding of the health outcomes of their school. It is arguable that this view to other levels of our own society should not be a privileged view in a Health Promoting society.

Removing the privilege of accessing progressively lower levels is not synonymous with anarchic change where unprepared Actors assume authority beyond their level of mastery. One of the opportunities of the metaphor is the opportunity to discuss the commitment and resolve needed to regain mastery of the power Health Promotion seeks to have shared among sectors and with people themselves. Representing settings in this metaphorical form and continuing to leverage virtual game playing presents an opportunity to promote setting problem solving in the cognitive spaces created by the model. Ideally, tenacious mastery of deeper levels becomes an act of empowerment cultivating a desire to recognize and potentially control the allocative and authoritative aspects that control setting health.

Within the ReInterplay Model change is determined by the availability of masterly mentors and adequate resources to effect successful outcomes, both in the virtual environment and in real life experimentation with modelled solutions. In this case study these aspects of mastery are evident in the design of garden programs around Garden Specialists, professional development for teaching staff, integrated curriculum and

demonstration schools. Peer to peer learning was essential in developing a vision of what change might be possible locally. Within the virtual model, engaged community members might develop additional features of the shopping centre level like higher-learning lounges, conflict resolution gaming arcades and artistic community displays to represent influences they would like to see as permanent features across all levels of institutions. In the context of applying the ReInterplay Model, the development of local expertise is essential to the community empowerment of the Health Promotion ethic and the progressive realization of a more ideal health promoting setting.

Meanwhile, the interactions of the deeper levels of the building may no longer be focussing on the interactions of their immediate level as much as the construction of Rules for other levels over which they exert control. Policy cycle actors at all levels of government have been involved in school food garden programs, from the advocacy of a local celebrity chef in Australia to the First Lady of the United States of America. In the metaphorical sense, the stability of the floor beneath your feet is being coded and strengthened from those interactions. It is just the influence of the manifest outcomes that are arriving and exiting via the staircase. There are interactions across all levels that are needed to educate children in our societies; the surface actions and outcomes, that are observable in a school setting or education department office, or in the offices of parliament, have created the material from which this four story structure is constructed. In the workings of the ReInterplay Model, wanting to change a school setting is likely to be insufficient in the absence of a working understanding by those Actors interacting within it as to what it takes to create and recreate that structure.

The ReInterplay Model's primary purpose is to engage communities in an interactive, exploratory, learning process. That process is characterized by their subjective understanding of the purposes of interactions in their setting, unique local factors, acting over a developmental time course, and culminating in recognition of health outcomes of all kinds. The ReInterplay Model is a tool to promote the process of structuring for better health outcomes as it evolves to become a normal part of the school's interactions and structuring.

6.3.4 Axioms of Change

Within the ReInterplay model are embedded opportunities to represent Sewell's five axioms of structural change. The axioms characterise aspects of the change process and are brought into place as the community finalising the setting model. It may be helpful to consider several examples of how a community may choose to represent each of these axioms within their model, remembering these symbols would be the community member's representations. The purpose of including symbols to represent axioms is to prompt thought and continue inclusion of these general principles of change over the time course of the models application and development. Let us consider two axioms in depth and the remaining three in chorus.

The axiom entitled Transposability of Schemas is a ubiquitous aspect of constructivist theorising where the lived experience of community members is being drawn on to create solutions from understanding they have learned elsewhere. The ReInterplay model created for a specific setting might represent these rules and influences from other social places, situations or institutions as neighbouring 'buildings' visible through windows. In the on going process of representing and understanding the setting, these views to other social locations are embedded as symbolic prompts to consider schema transposition and the origins of community rules and learnings. Perhaps particular views may represent particular learnings the community members are using as a model.

The axiom Multiplicity of Structures is a recognition that people interact with social structures simultaneously not sequentially. Perhaps the model created by a community may include representations of this in the form of communication technologies linking actors to the influences of the outside world, enabling influence to be exerted on local setting interactions. Alternatively, another community may choose to include symbols like flags, brands or insignia for an identical purpose. The impact that symbolic representation has on community members applying the model is the symbols importance; in this axiom, symbols signify influence from coexisting structures.

A principle of on going uncertainty is inherent in the axiom Unpredictability of Resources Accumulation. This uncertainty might be represented symbolically in the Patterns of Interaction zone of the model before the Outcomes on any level. It might be a simple symbol of chance such as a 'Poker machine'-like device issuing actors with an

uncontrolled resource allocation or generating 'horoscope'-style edicts as caveats on their interactions. Perhaps the community decide in their operationalization of their setting model that the individual actor is empowered to subjectively or contextually interpret the value of their allocated resources. In doing so the axiom of Polysemy of Resources is rendered in the understanding the community create of their setting from operating the model. Like Structuration theory, this model is a process; it can be related at any one moment becoming more meaningful with experience over time.

6.3.5 Progressively Deeper Levels

The final point to make with the help of the shopping centre metaphor is an environmental one associated with the necessity to enter the virtual building at an elevated 'street' level and move down through progressively deeper levels to the earth. This descent avoids creating an impression that interactions in successive social levels become less worldly, less materially or biophysically determined, less connected to people acting in place. Moving down successively to the foundations of the building represents the dependence of interactions in the settings of our daily lives as profoundly influenced by the biophysical resources of place. The Exogenous zone addresses biophysical aspects of local environments, however, the deepest biophysical level of the ReInterplayModel has a more profound meaning. It relates our society to our global place and draws to mind the Health Promotion pledge regarding countering pressures on this planet. This crucial environmental feature was lost in the two level model in which Rütten and Gelius (2011) initially communicated their proposition. They had abstracted social locations beyond our dependent connection with our place and our planet. Maintaining the interconnectedness of environmental, ecological, social, psychological and physiological aspects of health is essential for settings Health Promotion theory.

The above account has deepened theoretical understanding of the process of structuration in schools by detailing the theoretical development of the ReInterplay Model. It was written for a Social Science audience and describes the metaphors acting in the ReInterplay Model. Figure 6.9 is a composite illustration showing the relationships between the Structuration Links and ReInterplay models developed in this study. In order to serve a Health Promotion purpose, an equally important account of any theoretical model is the one provided for its lay audience.

Accessibility of a model to lay communities is indispensable if a Health Promotion theory is going to achieve the community-engaged action inherent in the Ottawa Charter pledges. An explanation that includes an application of the model as an illustration is likely to be more meaningful to a school parent or policy maker than an explication of concepts and theoretical precedents like the one above. Capturing that applied explanation and illustration of the usefulness of a model in non-technical language is key in creating successful communication between stakeholder groups differing in degrees of lay knowledge and specific expertise. This kind of lay explanation is needed if the ReInterplay Model is going to fulfil its potential as a tool through which to envision and action transition of school settings progressively closer to the ideal form of a HPS. Outlining such a lay explanation is the final objective of this chapter.

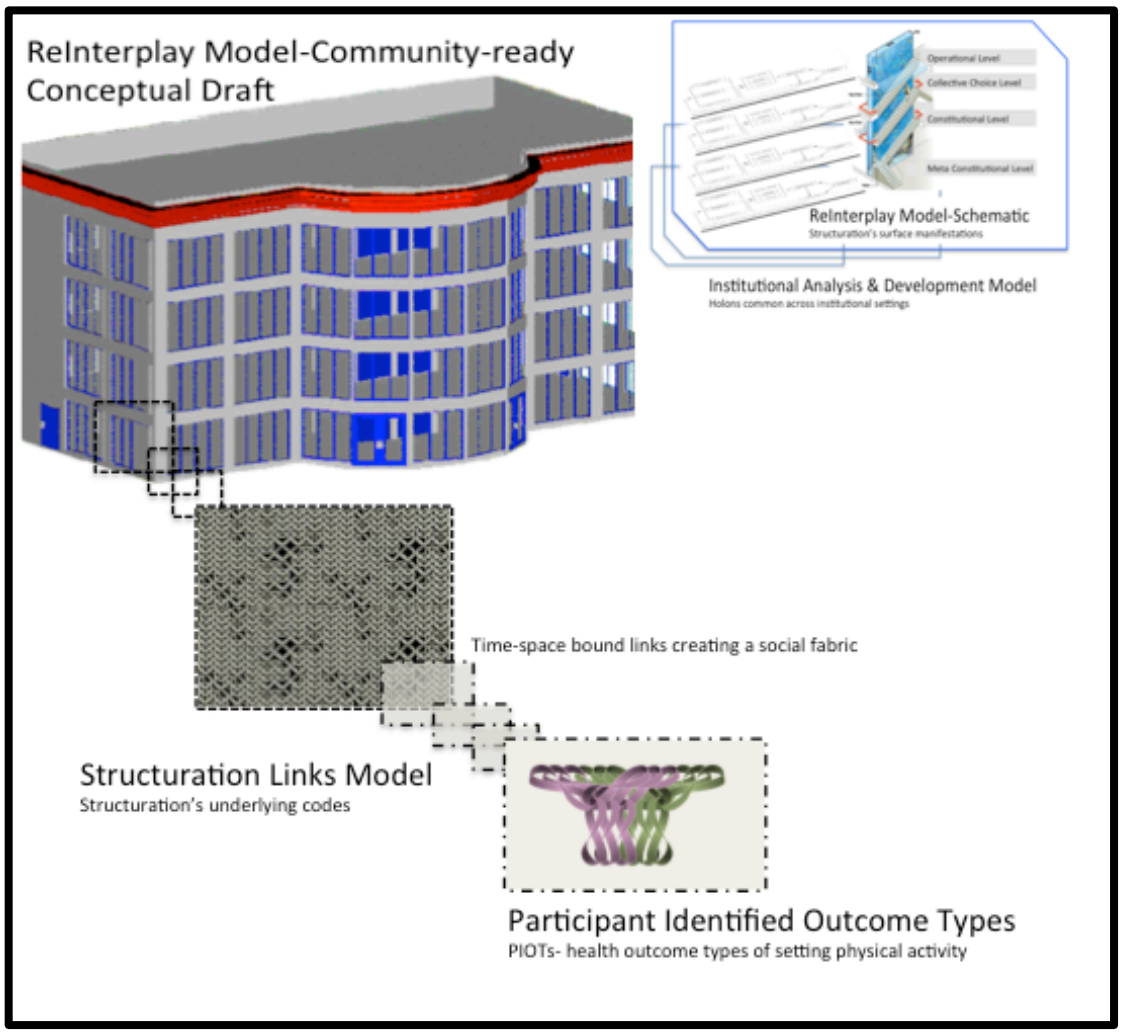


Figure 6.9 Relationship between the Structuration Links and ReInterplay Models

6.3.6 Explaining the ReInterplay Model to Lay Community Members

Despite its strong theoretical derivation, the ReInterplay Model is compatible with a lay explanation of school setting change and development. Introduction of the elements of the model should be preceded by an explanation of the model's purpose. That explanation should begin persuading the audience to relinquish 'quick fix' intervention strategies in exchange for an enduring development process over which they have group control. The concept of the Health Promoting School, the need for the application of the ReInterplay Model and relationship between interactions and the fundamental components of social structure could be introduced in terms such as those included in Text Box 6.2.

Text Box 6.2 Using this model can help all the people involved in a school discuss how the school can keep improving to become an even better school. A lot of people believe that a good school can be really healthy for the people in it. Some people believe that no matter how good a school is in the beginning, it can always be made better and healthier for the people in it. A good school getting better is a school where people are constantly and intentionally trying to make the school the most healthy and productive place to learn in, work in, to come to, and be a part of. A lot of people believe getting involved in the making of rules and finding resources for a school makes themselves and others healthier simply because they are interacting with other people and in more control of their lives doing that work.

People come and go through schools over time; families and staff move through the school in waves. The interactions of the current wave of people at the school makes a difference for the next wave; it changes what the school is like for the next wave and also their interactions at school and what they feel they can do there. When people start to see the school is a good school partly because of what they do but also partly from what people in the previous wave used to do, the current wave can start to think about what they could change to make the school even better, even healthier for the wave of people at the school now.

The explanation to a lay audience should continue, presenting the PIOTs in sufficient detail using concordant language with examples for illustration, as has been demonstrated in Text Box 6.3. The PIOTs have been themed from lay rationalities and should be inherently comprehensible. The community-wide importance of interactions in the setting should be re-emphasised.

Text Box 6.3 People from different schools tell us what happens at school, like a school garden program, can be healthy in three kinds of ways. It can be healthy for the body of those who go to the school to learn or work or be a part of the school community, even parents and the office staff. It can be healthy for the people at the school who actually work in the garden, like whether they have friends or can think things through for themselves or even do better at schoolwork. It can even be healthy for other people outside the school or those who don't even do gardening or whatever with the school. This is just because what happens at school ends up changing something that makes those people healthier. For example, perhaps kids from another school get to learn from the kids at this school when they are on a bus trip. Perhaps people buy the vegetables from the school markets or from the office. Sometimes people who don't necessarily come to the school become healthier just from the fact that having a good school in the area makes them feel safer and that has a flow on effect for them taking a walk around the streets. Some of those healthy things happen immediately, some of them take years to do a person good. Some of those healthy things were part of a plan, some of them just happened accidently. All these different ways of people becoming more healthy, come from the way people interact at school.

The change purpose of the model should be introduced through the concept of unintended outcomes and the focus on interactions extended to include reference to the deeper levels of the model. Text Box 6.4 provides an example of how this explanation might be achieved.

Text Box 6.4 The way some things at school turn out is not entirely the way they were intended and people interacting differently might make things better for everybody, or at least not bad for anybody. These interactions between people need to change for things to improve at school and using the model can help that happen. Finding out what things could be improved is why people with different points of view need to come together, use the model to help make their explanations and make plans to discuss and change interactions (either those happening within the school or by people outside the school with influence). By talking with other people interacting at school it is possible to make the school better, even if it was already a good school to start with.

A lot of people believe a good school is really the people and the way they interact more than just the school rules or the buildings or the grounds. They believe it's not just the interactions of the people who are at the school regularly but also the interactions of those people 'outside the school' and 'up the ladder' in the education department and the government that have a part to play in whether a school is a good school and keeps getting better. That is why the model has different levels. Understanding interactions that go on between the levels is important eventually but the most important thing is to understand the school level to begin with.

The model is used as a talking point so different people can explain their different ideas of the interactions at school from their point of view. By using the layout of the model like a pattern for the way they explain their point of view of the interactions at school, people might start to understand the way that all those interactions explained from all those different points of view, get connected up. They might understand that all those interactions at school fit together (and clash sometimes too). People might start to see from this connected model of their interactions that their interactions determine what the school is like *but also* that eventually what the school is like starts to determine their interactions too. Understanding that everyone at the school is connected by their interactions and that those interactions actually change the school is a really important first step.

Finally, the explanation should provide a description of the elements of the model and

the nature of the interactions between levels. The top section of diagram Figure 6.2 provides a layout of the elements in the Operational level and Figure 6.7 provides an image to support the shopping mall metaphor. These figures could be provided to facilitate the explanation and begin the customisation process. Laypersons can be encouraged to articulate imagined similarities to situations of their own experience. These customising metaphors need to be captured as part of the development process.

Examples of these final two aspects of a lay explanation are provided in Text Box 6.5

Text Box 6.5 This model starts with the interactions of people in the school setting. Interactions between people means every time people come together, so it includes of all the contacts, dealings, conversations, collaborations, meetings, connections, communications, exchanges, discussions, relationships, networking and community participation that goes into creating a school. The people have different roles in the school and positions. When people interact there is an outcome that is directly linked to the action taken between them. How that outcome is judged depends on who is doing the judging and what they are looking for from the outcome. Often those decisions are not at the control of the participants. Someone from somewhere else (maybe someone who wrote a school policy and hasn't even been to the school) gets to decide. The outcomes change the interactions or the general context of the setting, in either a good or bad way. Whether outcomes are judged as good or bad depends on what information people know about the outcomes and who is making the judgement call. The costs and benefits are decided and the outcomes that change the context have an indirect impact on the next wave of interaction. Sometimes this context of interactions is thought of as the school ethos because it involves the values of people making judgements.

and Text Box 6.6

Text Box 6.6 The model has four levels. It was intentionally made to look like a shopping centre map, so that it is easy to think about all those people making decisions on different levels. Each of those levels represents the setting of the education department, or even the Government, interacting just like other normal people in their daily lives. The outcomes of their interactions are evaluated just like has been explained in the school level. The outcomes influence directly the interactions of that level or indirectly through influence on the conditions. The outcomes of those interactions influence up through the levels until they have an impact on the interactions of the people at the school level.

These interactions on different levels and between different levels are starting and finishing and starting again, over and over. By changing the interactions of one wave, the next wave must change or change back and so the interaction cycle in that part of the model starts again. To make change to a school setting requires persistent change to the daily interactions on the school level, on other levels and between levels for as long as it takes for the new way of doing things to become established. Eventually those actions and decisions get turned into rules and orders to provide new programs and facilities. Those interactions eventually create the legacy of the people who started developing the school.

The explanation of the ReInterplay Model to a lay audience requires the progressive introduction of theoretical concepts responding to a community's requests for clarification as they develop skills and sophistication. Lay people are unlikely to struggle with the concepts of health that underpin the PIOTs as community people were the source. They are unlikely to find unfamiliar the notions that a good school setting is good for the health of their children or that good schools are the result of the daily actions, decisions and interactions of people in the school; they are unlikely to capture these thoughts in the term HPS. They may be frustrated, as many Health Promotion professionals are, with the apparently slow time frames of setting change, especially change with its source in the interactions of people on other levels of society; this risk should be mitigated with reference to valued long time course change that has occurred in the setting. The ReInterplay Model should provide an effective communication tool and a way of challenging short-term, single-strategy, single-level interventions adopted without the complementary co-presence of an on-going setting process.

The final objective is to describe how a Health Promotion practitioner could select this theory and its model for use to engage with a community and develop and implement some kind of HPS action.

6.3.7 Application of the Model in a New Setting

Applying the ReInterplay model to a new setting is an empirical and theoretical analysis conducted by the community, facilitated internally by an experienced community or an external investigator sensitive to their function as resource to the community. The following description assumes the community members have been familiarised with the layout of the ReInterplay levels, Structuration Links 'micro-structure' and relationship between them. It also assumes the concepts of the Ottawa Charter and Sewell's axiom have been introduced and the community has been invited to begin to create symbolic representations of these as an array of common objects to add to the visual model as they develop it. It has been explained that objects represent concepts and act as memory hooks in order to facilitate recall and access by community members. A facilitator has the responsibility to direct the attention of community members to these conceptual 'objects', the power they instil and the potential for including them in the zones and levels of the virtual environment. The facilitator should prompt the community regarding the concepts and axioms as they conduct their analysis.

A new community begins their analysis with the identification of the Action Arena at the Operational Level of entry of the model, as is also the case in an IAD analysis. The next step is to describe the characteristics of the participants, their positions and the interactions between them. At this point the community begin the process of abstracting their individual presence in the school to the presence of archetypes- the custodial staff, the teachers, specific social cliques in the student population etc. Their next task is to identify the interactions that occur between participants and start to represent them in the model as enacted by their archetypes.

The physical actions of the community need to be considered through the micro-lens of the Structuration Links. The facilitator must now ask the community to consider the physiological, contingent and consequent health outcomes of the identified interactions, in the particular times and places they occur. Empirical evidence might be added to prompt the discussion, however an external facilitator must respond to the community expressing need rather than direct it. Decisions to narrow or prioritise the focus of the

analysis or change process may emerge at this time or later. There is no boundary in creating this virtual environment between the reflexive process of recognising the existing setting and the creative process of designing change to it. One must be able to imagine a realised demonstration of this environment like a town hall meeting where a school community continue to debate the next version of their more ideal floor plan, where previous layouts are resurrected for further critique or to demonstrate the wisdom of choices made and agreed to. The ReInterplay model remains theoretically sound as long as it continues to explain the setting and enable the community to recognise where change might occur to improve health outcomes.

Moving attention to the far right of the model, the community now begin to report observed or actual outcomes and conceive of potential ones. The facilitator guides the community through a discussion of their school interactions to elucidate an understanding of the information and control they have to direct current outcomes and effect alternate outcomes should they choose. The metrics and indicators of their outcomes should dominate discussion at this point. The community members determine the importance of particular outcomes from any level of the model; it is their information need that drives discussion of the measurement of outcomes. Inclusion of community members with access to other levels is an advantage to the group's understanding.

The community must then determine the places where those outcomes have an impact. These places include the action arena themselves, the exogenous factors of rules, community and biophysical or whether the outcomes go on to inform or impact on another level of the model. As this part of the analysis occurs influences coming from other levels may be identified. Deeper levels change rules-in-use; this relationship down through the successive levels is carried forward to the ReInterplay model from the IAD framework. Conversation of this nature is likely to include discussion of resources, policy, administration procedure or bodies, current governments and collaborative organisations the school community is a member of.

The implementation process is responsive to the motivations and entry points determined by the school community. If one imagines a process where the objective is to transition a chaotic high school setting towards a HPS, the first steps might be to identify the actors in the school space. As a HPS promotes the health and wellbeing of

all members of the school community, the composition might prove to be diverse and include actors who transition to other levels of the model. Members of the school might include officers of correctional or detention departments of government, private security contractors and their personnel, or the infant children of students.

Entry into the model is determined by the motivations of its use. For example, it may come from understanding the nature of interactions in the school space that lead to a specific outcome at the operational level. Such an application of this model might be motivated by the desire to bring peace to a violent school setting. Alternatively, the entry point may be through a particular Structuration Links health outcome type at the micro- or 'fabric"- level. Entering the model through the physiological, contingent or consequent outcomes of historical interactions that continue to influence conception rates might be an example of this.

Application of the ReInterplay model will elicit observation of outcomes instigated by interactions from other setting levels. Recognising distant sources of influence and attributing partial responsibility to action arenas on other levels or health outcomes from time distant situations is an important part of the community understanding their scope of influence. Modelling these influences is an essential step in recognising the extent of their agency, the power of structure and the formative relationship between these factors in setting change processes.

In the example of the chaotic high school, perhaps an insufficient number of policy-regulated senior teaching staff is observed in the constitution of participants in the school community. Recognising this as a group level interaction impacting on the exogenous variables of resourcing is a significant shift of emphasis from the individual school participants unaware of the health impact of an impoverished leadership environment in the setting. The process of applying the model explains the setting for the school community members and shifts their understanding of the process of changing their school.

Continuing in the example, perhaps interactions between students of different ethnicities are hostile and poor retention rates are skewing the student population profile. Using the Structuration Links model may help the community identify the historical drivers in their hostile interactions. The model could be used to analyse hostile interactions and examine the physiological, contingent and consequent health outcomes of the hostility.

Perhaps hegemonic gender roles are identified as a consequence of a hostile setting effected by violence.

Understanding hostility impacts perpetrators as much as victims, through these types of setting health outcomes, may motivate and empower the school community to envisage alternatives or instigate change in specific routine and regionalised interactions. Realistically, the change might be a sub-optimal and interim solution; perhaps a more plural but less hostile school culture develops rather than a more diverse and accepting one. In such a case, implementation of the ReInterplay model could continue to provide community members with a way to conceive their unique set-wise pathway to developing a HPS form in their school. The strength of using the model in an enduring process is that the broader social context at the meta-constitutional level of society, say for example multi-culturalism or pluralism, can be acknowledged as having influence on Health Promotion conducted in operational level settings such as schoolyards.

6.4 Chapter Summary and Conclusion

This chapter has described the ReInterplay Model, a multi-level, multi-institutional theory modelled from the components of an existing theoretical proposition to which were added theoretical advances made in the course of this case study. The form of the model was chosen to facilitate accessibility and collaboration with community members. The component theories of the model were described with reference to the case study data and the model was explained. The chapter closes with annotated examples of narrative describing the model to a lay audience.

The ReInterplay Model incorporates the Structuration Links Model with the multi-levelled Institutional Development and Analysis Framework (Ostrom, 2005) through the concepts of structuration's 'underlying codes' and 'surface manifestations' (Giddens, 1984). Units from the Structuration Link Model equate with structuration's 'underlying codes' in a micro level view while interactions cycles of the IAD framework levels were imagined as structuration's 'surface manifestations' in the macro level view. The repeated 'surface manifestation' cycles create multiple units of Structuration Links that, because of their spatial relationship in the setting, enmeshed to form a fabric of action-outcome linkages. In this way the subjective rationalities of

community members, specifically their reflexive cognitions regarding physical activity and health, are represented as constituting the fundamental fabric of social settings and institutions.

The ReInterplay Model is a tool of communication and explication. It has deep theoretical roots and yet translates into a visual metaphor as familiar as a map of the local shopping complex. Leveraging the sophistication of the lay visual language masks the customary complexity of social theory models making the ReInterplay Model useful for the visioning and communication of empowering setting solutions from a Health Promotion perspective. The model represents an advance in Health Promotion theory that has immediate applications in school settings policy and change agendas. With further work, even wider applications could be discovered in health services, government services and private settings for this multi-level metaphor.

The final chapter discusses observations from this case study that suggest the ReInterplay Model may be useful in addressing the issue of transitioning schools closer to the ideal of the HPS setting.

7 DISCUSSION

This chapter concludes a case study investigation of the physical activity of food gardens in schools aiming to advance school setting Health Promotion theory through structuration and institutional development approaches.

The objectives of this chapter are to summarise the findings of the case study, identify the theoretical advances made and discuss the significance of these. Discussion of the findings will address local optimisation of health outcomes from school Health Promotion programs and the need for continued development of concepts, methods and methodology in the investigation of physical activity from a Health Promotion perspective. The theoretical advances of this study include the development of the Structuration Links Model and the ReInterplay Model. Discussion of the significance of these advances addresses implications for the future of Health Promoting Schools and the use of social theory in settings Health Promotion. The limitations of this current study are identified and suggestions made for further research and theorising to address them. Practical and policy applications of the theoretical advances made by this study address the governance of school Health Promotion Programs at local and institutional levels and draw discussion of this case study to a close. The chapter concludes by articulating answers to the two research questions.

7.1 Summary of the Study

This study set out to study an established school setting initiative for its potential to realise additional health outcomes, specifically the potential of food gardens in schools to increase physical activity. The case study had the theoretical objective to inform further development of Health Promotion theory by investigating advances to school setting Health Promotion theory through structuration and institutional development approaches. The study addressed two research questions. They were:

Do food gardens in schools have the potential to increase physical activity?

What advances to school setting Health Promotion theory can be made using structuration and institutional development approaches?

These questions were approached with evidence obtained from the application of a number of methods, as is the practice of the mixed methods methodology. The methods themselves were the subject of critical consideration in the context of the ethnographic experience of the school setting. Methods applied included accelerometry, time-lapse photography, video-imaged qualitative observation, semi-structured interview and photo-elicited group interview. This was a descriptive case study and, accordingly, the recruitment strategy was purposive.

The first research question was answered in the affirmative. Given certain caveats concerning attendance, timetabling and programming, food gardens in schools have the potential to increase physical activity. School food gardens are a current location for physical activity. Their potentials for increased physical activity are related to the current volume and intensity of physical activity at each school site. These volumes and intensities vary across garden sessions and represent more or less physical activity as compared to other school day segments. Considering the garden and the kitchen sessions as a combined program significantly reduced rates of volume and intensity of physical activity observed as compared to consideration of the garden sessions alone. Even for this small number of sites, local school factors had such a unique pattern of influence that generalised recommendations to increase physical activity were not possible. The accelerometery results show a local optimisation of health outcome potentials is needed for a garden program to provide an increase in physical activity and meet its original intended health outcomes.

As anticipated, accelerometery proved an insufficient method by which to investigate whether there were realisable opportunities in the school setting to increase physical activity from the identified potentials. Visual data and qualitative descriptive methods were introduced, revealing flux in the potentials within these diverse school food gardens. Time-lapse photography showed the gardens to have a capacity for greater use however increased diversity in garden space activities other than the garden sessions was not evident. One can conclude diversity in garden space activities was not necessary for program sustainability in these schools at least. Sessions were found to have the potential to influence health outcomes through the purpose of the physical activity in addition to its measured volume or intensity.

Qualitative observation of the garden sessions and a thematic analysis influenced by the theoretical approach of structuration revealed a number of conceptual factors and associated elements in understanding physical activity from a Health Promotion perspective. These elements were the importance of subjectivity, normalised biophysical diversity, recognition of unintended consequences, acceptance of a human development time course, implications of purpose, whole setting interactions and the sanctity of physical autonomy. These concepts and their significance in the relationship of physical activity to health in the school setting founded the theoretical development process of this case study. The pledges of the Ottawa Charter were posited as a Health Promotion ethic and used to denote the perspective of Health Promotion. This use of the pledges as an ethic ensured the integrity of the Health Promotion perspective was retained in the theoretical development that followed.

The interview methods of the study explored subjective connections between the garden, physical activity and school setting health from a participant perspective. The responses provided insights into a diversity of subjective health outcomes from physical activity in the school food garden. Themes from the analysis of these data were typified. Three participant identified outcome types (PIOTs) were recognized in the participant interviews. These outcome types were given the labels of Physiological, Contingent and Consequent Outcomes. The Structuration Links Model was developed in positing the relationship between PIOTS. This model informed subsequent theoretical development of the ReInterplay Model.

Development of the Structuration Links Model and ReInterplay Model proved the value of structuration and institutional development approaches in school setting Health Promotion theory and answered the second research question. Structuration and institutional development approaches are valuable in school setting Health Promotion theory. Achievement of the theoretical objective of this study occurred in three stages. The first involved determining a conceptual model for the individual PIOTs. The second involved modelling the relationship between the three PIOTs, resulting in the Structuration Links Model. The third involved modelling the ReInterplay Model produced by integrating the Structuration Links Model with the component theories of an existing theoretical proposition. The ReInterplay Model is described in its novel multi-levelled form, expressed in a visual language intended to facilitate accessibility.

Social interaction over the passage of time unifies agency and structure. Each PIOT was modelled as an individual Mobius band, enabling a structure:agency duality to express the dimension of time through the band's geometry. The use of the Mobius band in modelling enabled agentic and structural aspects of each PIOT to be represented as the apparently opposing but irreducible surfaces of the band. Considered in the moment, the two surfaces of the band represent a duality, similar to the 'two sides of a coin' analogy previously used to describe structuration (Rütten & Gelius, 2011). Considered in perpetuity, rotating the bands to represent passage of the unbounded time course of social interaction in a setting, a unity of the key structurating parameters is revealed. This unity was the relationship observed between the health rationalities of school food garden physical activity and the school setting.

Health outcomes are the foundation of social structures. The three PIOTS were related to each other through their representation as an interlinked assemblage of three Mobius bands, demonstrating the non-causal and reflexive rationality that characterizes the structuration influenced and spatially bounded relationship. The linkage of the model permits the representation of a connected, influencing, but essentially fluid form of rationality relationship between the types of health outcomes participants identify from the physical activity. The bands form a chain-linked arrangement such that each PIOT remains inextricable from, but independent of, the other two. A single unit of the Structuration Links Model can interlink with other units to form a mesh like fabric. This inter-linkage of rationalities and outcomes in a setting represents a school settings microstructure, a result of physical activity enacted in unique time and space bounded locations. Given the continuance of structure and agency in present moments, the outcomes continue to be generated, renewed and reshaped.

An institutional development approach to setting theory advances a Health Promotion perspective of physical activity. An existing theoretical proposition (Rütten & Gelius, 2011) was identified during the preparatory phases of this case study. It revealed immediately apparent possibilities to influence the understanding of physical activity from a Health Promotion perspective. The proposition was untested in the highly institutionalised school setting and the graphic model failed to illustrate the prospects of a multi-levelled vision of the school context. Consequently, the objective of the

theoretical aspect of this study went beyond a novel theoretical application of Rütten and Gelius's proposition and became the theoretical development and remodelling of it.

The third stage of the theoretical development process had its roots in the early deconstruction of Rütten and Gelius's (2011) proposition into its component theories. Their proposition is essentially a reasoning of the Institutional Analysis and Development (IAD) framework (Ostrom, 2005), Structuration Theory (Giddens, 1984), Theory of Structure (Sewell, 1992) and the Ottawa Charter (WHO, 1986). These component theories were allowed to influence analysis of empirical and ethnographic data from the case study. The influences are evident in the factors and conceptual elements of physical activity from a Health Promotion perspective, the importance placed on subjective rationalities in modelling the PIOTs and the re-emergence of a multi-levelled form for the ReInterplay Model.

Conceiving and constructing the Structuration Links Model and ReInterplay Model are significant theoretical contributions of this case study. One unique aspect of these models is their representation of subjective health outcomes of physical activity and reflexive cognition as the basis of social structuring. Respectively, the models represent structuration concepts of 'underlying codes' and 'surface manifestations' translating the actions of daily life into fundamental units in the constitution of social structures.

Conceptually, the multi-levelled ReInterplay Model is constructed from multiple Structuration Links. These accumulating links enmesh during the multiple moments of interaction that are related spatially in a setting, creating a chain mesh 'social fabric' from which the ReInterplay model is constructed. The micro level of the ReInterplay model is a self supporting chain mesh of health rationalities that translate into a multi-levelled institutional macrostructure. Consequently, the interaction of the macro level is imperative to the on-going generation and regeneration of the micro level. The micro level is imperative to the on-going integrity of the macro level. Sewell's change axioms (Sewell, 1992) and the pledges of the Ottawa Charter (WHO, 1986) are rendered within the relationships linking elements of these perpetuating micro and macro levels. The extent of expression of the axioms and pledges determines the Health Promoting nature of the setting being modelled.

Finally, the ReInterplay Model was imagined as a virtual environment and presented in a conceptual form. The virtual environment was described to facilitate community accessibility however development beyond the conceptual form was outside the scope of this study. Continued development of the virtual environment of the model will be addressed in later discussion of study limitations and future research. Examples were provided of how the ReInterplay model might be introduced to a non-academic audience and applied in a participatory policy development process in school settings.

7.2 Significance of the Findings and Wider Theoretical Implications

The case study findings indicate a need for local optimisation of health outcomes in established school Health Promotion initiatives and further investigation of the distinctive conceptualisation of physical activity from a Health Promotion perspective. The Structuration Links and ReInterplay Models make a significant theoretical contribution to hypothesising pathways for the emergence of Health Promoting Schools from existing school Health Promotion programs. The models also provide theoretical insights into the structuring of broader institutional settings for Health Promotion. They are a practical tool of communication and a theoretical tool for abstract reasoning.

The implications of these are discussed in turn below.

7.2.1 Local Optimisation of Diversified Outcomes

Local diversification is part of the natural evolution of established Health Promotion programs (Belansky et al., 2013; Gaglio et al., 2013). Local optimisation is needed to balance the net benefit of the program on the health of the local school community. Local adaptation made to enable the sustainability of a program for its original purpose may have inadvertent consequences on other significant but unintended health outcomes. The findings of the accelerometery and visual methods of this case study provided an insight into the nature of the diversification. Such was the extent of difference in the food education programs now operating in the schools, that a recommendation aimed at making positive change to physical activity in one school, may create an effect in the opposite direction at another. These school sites now require a thoughtful process of local optimisation to maximise their food education and physical activity health outcomes.

This need for local optimisation is a significant issue as regards unintended health outcomes of programs. The impacts of program adaptations on important but unintended health outcomes are usually unmonitored. The low propensity of Health Promotion practitioners to revisit established programs is problematic. Standardising the practice of revisiting initiatives should be considered in order to measure significant health outcomes that might *reasonably* have been anticipated at the time of design but were ancillary to the program's principal intention. While it is best practice to conduct follow up program evaluations to measure intended health outcomes at various time points (Oja, Martin, Foster, & Cavill, 2006), it is a rarer thing to revisit a program and begin monitoring unintended outcomes recognised after the design phase (Spencer, 2014). Such has been this case with physical activity in school food garden programs.

Additionally, not all ancillary health outcomes can be reasonably anticipated during the design phase. A plethora of subjective reflexive health outcomes were identified in this study by program participants invited to reflect on the relationship between physical activity, their food garden program and health. Based on evidence from qualitative methods, these health outcomes arise from the rationalities of the local participants and, by their very nature, are outcomes that might *not reasonably* be foreseen by outside agents (Giddens, 2009; Goffman, 1990) nor program participants either. Being reflexively identified, the program participants may not sensibly be expected to be sentient of the possible outcomes in advance; they are unable to know of them until after having engaged in the reflexive process they are enabled to articulate them (Giddens, 1984).

An example from this study of a reflexive outcome is the perception of an increased diversity in the school community from changed school enrolment patterns believed to be a result of the presence of a food garden in the school. This discovery would have been inaccessible in the absence of reflexive thought on health outcomes. The findings of this study add weight to the body of evidence that questions our capacity to externally evaluate Health Promotion programs in the absence of a community process (Potvin, Cargo, McComber, Delormier, & Macaulay, 2003; Vollan, 2012). Outsiders to a community are unable to pre-empt all possible health outcomes of a program precisely because those outcomes can only be identified reflexively. The consequence of

evaluation in the absence of the community is a failure to recognise the full impact on health of programs with unintended consequences of significance.

Local optimisation requires a mode of implementation. Routine reflexive consideration of subjective health outcomes in a settings context is a viable mode and an alternative to revisiting each individual program initiative in turn. The results of this case study support continued development of the settings approach in school Health Promotion to facilitate local diversification of centrally designed Health Promotion programs. There is an ethical obligation enshrined in pledges of the Ottawa Charter for the discipline of Health Promotion to support school communities in their efforts to optimise the full spectrum of effects arising from programs, including their unintended and reflexively recognised health outcomes. Local optimisation has the power to create a multiple health outcomes program from what may have been initially implemented in a school as a single health outcome program. Routine reflexive consideration of settings health outcomes is in keeping with the ethics of the Health Promotion approach.

It can be argued that local optimisation is a part of the incremental establishment of a settings approach to Health Promotion. This is the case if local diversification of existing programs develops multiple health outcome programs from the unintended outcomes of more narrowly conceived programs, assuming this is done with significant community involvement. Theoretical insights from this study can be used to explain and facilitate this incremental establishment of settings Health Promotion. From this study and the work of others (Fung et al., 2012) it is apparent there are a number of ways in which a program might impact the health of a child. Local optimisation through a participatory process is essentially the community taking a leadership role in the strategic planning of their setting.

One application of the ReInterplay Model is as a tool to facilitate strategic planning by the school community in their efforts to determine the programs their school should engage and invest in. These decisions form the basis from which later unintended health outcomes emerge through the process of diversification. Schools are regularly approached to participate in a number of initiatives and significant health outcomes compete for program implementation (Vinciullo & Bradley, 2009). School programs are costly investments made by the school community (Eckermann et al., 2014; Yeatman et

al., 2012) limiting a school's capacity to undertake large numbers of them. Use of the ReInterplay model to select programs and facilitate the local optimisation of their health outcomes might assist the integration of a school community's own health agenda with centrally determined health outcome priorities. This makes the Structuration Links and ReInterplay Models useful for the purposes of securing institutional support for the schools interests and, for the society, in achieving sustained local engagement in national targets.

7.2.2 Concept of Physical Activity from a Health Promotion Perspective

Related to a recognition and appreciation of the unintended consequences of school Health Promotion programs is the continued development of a distinctive conceptualisation of physical activity from a Health Promotion perspective. The observational evidence of this case study analysing the food garden sessions in the school setting makes a contribution to what should be an on-going conceptual development process. This process would be better served if it included input from the widest variety of social places. In the school setting these social places might encompass before and after school care services, classrooms, schoolyards and modes of transport between school and home.

Conceptual challenge is necessary for disciplinary development (McQueen et al., 2007). The behavioural sciences conceptualise physical activity in terms of significant gross movement of major muscles such as expressed by Caspersen, Powell, and Christenson (1985) in their oft referenced definition of physical activity or in the concepts of volume and intensity such as referred to in the opening of this thesis from Pate's definition (Pate, 1995). This study sought a Health Promotion perspective and used the pledges of the Ottawa Charter to posit seven factors observed in the garden physical activity as being determinant of its relationship to health. Transience was the first notable factor; the variability of effort or resistance characterising garden activity led to an inescapable inclusion of the subjective. The influence of specific biophysical locations highlight the factor of normalising diversity in living conditions, not in the mathematical sense, rather by the simple acknowledgment of diversity being the normal state of being. Variation in physical activity directed by the dynamics of social interactions being enacted, Goffman-like (1990), was an evident factor. The presence of children themselves was

sufficient reminder of the development time-course as a factor necessary in the consideration of physical activity for health. The socialising function of the physical activity and the potential for influence from the presence or absence of adults became obvious factors especially in this school setting program; equally so was the importance of an activity's purpose as a factor from a Health Promotion perspective. Finally, bearing witness to children armed with tools loose in an outdoor environment left the indelible impression of the combined forces of personal restraint, social control, choice and opportunity for freedom of movement, and, ultimately, elements of the sanctity of physical autonomy- the final factor identified in this study.

Behavioural science measures one concept of physical activity; there are other concepts. The one emerging from the data of this study is physical activity from a Health Promotion perspective. It was the taking of a subjective perspective and valuing the health rationalities of program participants in this study that enabled the concept of physical activity from the Health Promotion perspective to be distinctly distinguished from the concept of physical activity from a behavioural science perspective. Subjective health rationalities can only assume a secondary significance in a behavioural science concept because it requires a comprehension of anatomy, a systematic recognition of what constitutes significant movement or a scientifically validated method of measurement; this is an inescapable consequence of the Caspersen and Pate style definitions (Caspersen et al., 1985; Pate, 1995). The WHO definition of health (WHO, 1948), the prerequisites of health, and the pledges of the Ottawa Charter (WHO, 1986), all dictate a concept of physical activity that is more comprehensive. Health as wellbeing and Health in All policy approaches challenge any concept of physical activity that suggests volume and intensity are determinant in physical activity's relationship to health.

Behavioural intervention programs in schools rarely increase physical activity significantly or for a prolonged time course (Brophy et al., 2011; Demetriou & Höner, 2012; Harris, Kuramoto, Schulzer, & Retallack, 2009); while a recent Cochrane review of settings approaches found them to have a strong result in a diverse range of health outcomes including physical activity (Langford et al., 2014). This case study argues the setting approach is a rational conclusion to the local optimisation of program adaptation

and the pursuit of health and wellbeing through physical activity promoted from the conceptual perspective of Health Promotion.

7.2.3 The Future of Health Promoting Schools

The significance of the ReInterplay Model lies in its utility for hypothesising structuring of healthy school settings from the physical activity that embodies interactions in daily life. Among these hypotheses are those that explain the emergence of Health Promoting Schools from established school Health Promotion programs.

The HPS movement is shrinking in Australia (Giles & Yeatman, 2016). Isolated local HPS initiatives provided 'proof of principle' information and enrich the lives of individuals in a select number of communities (Lynagh, Knight, Schofield, & Paras, 1999). Approximately four million Australians live significant parts of their daily lives in schools settings (Australian Bureau of Statistics, 2016). The impact on health in a population of that size must be questionable where implementation is restricted only to a local scale. Of additional ethical concern are the effects of local processes of selection promoting unjust and inequitable variance between communities as a result of their inherent capacities and capabilities (Spencer, 2014). The public health principles of equality, equity and social justice are at risk when school Health Promotion programs are selectively accessible; this is of special concern to those attempting to keep the hope of HPS viable through a local or community governance approach (Samdal & Rowling, 2012; Senior, 2012; Spencer, 2014). While local scale change is fraught with the possibilities of inequity, implementation of system change policy takes a political constancy of will (Denman, 2002; WHO, 1995a; WHO, 1995b). A significant potential application of the ReInterplay Model, leveraging its ability to link local and institutional levels of understanding, would lie in hypothesising the resurgence of a more centralised HPS movement.

The strength of the ReInterplay Model is its capacity to hypothesise institution wide responses while remaining inclusive of those that are based in a local governance approach. When applied as a policy analysis tool, the model can be used to describe an incremental transition of the institution and its interactions towards the ideal of a HPS setting. Together the Structuration Links Model and ReInterplay Models provide a view of the school setting that extends from the health rationalisations of the setting Actors,

through socio-political levels to finally become grounded in the place of the biophysical world. Accordingly, these models depict the full scope of Health Promotion action; from the minutiae of local setting health education sessions to the field of view necessary for global environmental policy. Inclusive of the change-capable elements of social environments, the Structuration Links and ReInterplay Models could be useful tools in a hopeful, solution-based, enabling of settings, one undertaken on a sufficient scale to impact population health.

The Health Promoting School is considered the preeminent form of a healthy school setting (Langford et al., 2014). Much has been written about HPS as a social space whose form and function promotes the health and wellbeing of all those present (Kickbusch & Jones, 1998). However, unifying form and function in a model is not as easily achieved as writing about them as separate concepts. To achieve such a model requires taking that which a HPS *does* and that which a HPS *is* and representing these irreducible concepts as a unity. Where Rütten and Gelius (2011) began this reunification with the process-thinking of structuration, the ReInterplay Model moved closer to realising a unified outcome with the introduction of the Structuration Links Model. Drawing on structuration's concepts of 'underlying codes' and 'surface manifestations', the ReInterplay Model was able to depict the unity of form and function. This achievement enables users of the model to envisage structuring as the creation of a virtuous cycle (Kickbusch & Jones, 1998) where the agentic process recursively improves the capacity of settings to promote health of their own accord.

Already the opening of this section has described a pathway of local optimisation of unintended program outcomes as an incremental transition to HPS. There are undoubtedly other pathways; not all pathways will have such positive waypoints or endpoints. Designed from a Health Promotion perspective, the ReInterplay Model is a model with an inherent capacity to represent a realistic change process, with its gains and regressions, promotion and its reverse process. Irrational misinformation, the loss of a program or its funding base, influences on interactions from social unrest or a shifting biophysical environment, changes in policy and lack of leadership at any institutional level can precipitate the Health Promotion equivalent of structural decay. The health prerequisites of peace, shelter, food, income, eco-system, resources, social justice, and equity (WHO, 1986) can equally unravel within a school setting. From the standpoint of

the ReInterplay Model, the result of interactions can proceed in any direction, creating the structural responses that lead to a HPS or not. The model challenges curative assumptions of an intervention approach and shifts consideration to the implementation of an enduring process of HPS structuring.

HPS is a notional concept (Aggleton et al., 2010). Accordingly, implementation of a HPS cannot proceed to a nominally successful endpoint because each notional aspect may or may not feature in the form and function of a particular HPS school (Kickbusch & Jones, 1998). The transition to a HPS form cannot be achieved through a project style process driven by a Plan-Do-Check-Act cycle (Lynagh et al., 1999; Senior, 2012) because of the HPS's definitive notional nature. Formative notional aspects of a HPS may even be unintended consequences themselves. This cycle is in the domain of program implementation not the structuring of settings. It requires prescription of HPS features that may drive the interactive structuring process towards failure. The notional concept of a HPS must resist reduction to a quasi-professional compliance checklist, or, alternatively, yet another accreditation-dependent tactical funding ruse of school administrators (Hazzard et al., 2011; Hazzard et al., 2012; Hazzard et al., 2012b). The program that seeds a HPS may start in either of these unconstructive ways but with the use of the ReInterplay Model alternative between-level interactions can be modelled.

The theoretical findings of this case study have significant implications for the future of school setting Health Promotion, physical activity from a Health Promotion perspective and Health Promoting Schools. Each of these is related to continued strengthening of the discipline and practice of Health Promotion through the development and application of Health Promotion methods, methodologies and theories.

7.3 Limitations of the Study and Future Research

This study was limited by the inherent influences of a case study methodology and the early state of development of conceptual and theoretical traditions in Health Promotion. The primary limitations were consequences of the choice to use a partitive, spatially bounded approach to studying physical activity in established food gardens in primary schools. Further limitations were the consequence of selecting a theoretical proposition

that had not been developed for application in an institutional setting. Future research to investigate the relationships of physical activity to the structuring of settings and the continued development of Structuration Links and ReInterplay Models are proposed in the context of these limitations. While these models have a demonstrated utility in hypothesis generation, their power to explain must be tested through further research.

The most pressing recommendation for future research is to observe a wider variety of Health Promotion programs prospectively, in more diverse institutional locations, using comparative contexts. There is a need to observe changes in the physical activity, interactions and subjective reflexive cognitions of school community members as the program targeted by future study becomes established and potential structuring of the setting occurs.

This case study was *not* able to mount a prospective analysis of the explanatory power of the Structuration Links or ReInterplay Models. While the case study allowed the theoretical development of the models, the scope of the study was insufficient to do more than demonstrate their capacity to generate hypotheses. While hypothesising a transitional emergence of HPS from established school Health Promotion initiatives was possible, the testing of this hypothesis is a necessary next step. The greater the contrasts in the sites chosen for future research, the greater the comparative opportunities in the conceptual factors of physical activity from a Health Promotion perspective already recognised by this study.

This hypothesis testing process might usefully commence investigating the physical activity of food gardens in schools at different stages of establishment. It might take a less partitive approach and investigate whole school physical activity, inclusive of active pedagogy, active transport, active leisure, active co-curricular programs and active school break times. It might investigate schools in different systematic contexts educating people at different ages and stages of development. Study sites should be selected from diverse biophysical and psychosocial locations. Longitudinal investigations should extend into the period where the school community becomes engaged in a process of local optimisation of unintended health outcomes.

Evaluation of the application of the ReInterplay Model by non-academic participants is a necessary component of future studies that should focus on the claim of improved

accessibility through familiar visual language. A comparative approach is needed to record local divergence in emerging structural form and to provide evidence of the nature of interactions and especially their influence on the development of notional aspects of a HPS. The focus of these comparative studies should be school structuring ahead of 'successful' program implementation; a so-called 'unsuccessful' program implementation may prove equally insightful.

The schools chosen for this study had a demonstrated capacity as settings capable of sustaining food garden initiatives. A limitation of the current study is the lack of exploration of this capacity and its effect on structuration. Future investigations should do more to understand the capacities and capabilities of school communities with established school food garden programs in the context of their influence on setting structuration. Work might be instigated to investigate the combined effect of a community development approach and school setting structuring through the physical activity of a food garden program. Establishing the use of the ReInterplay Model to investigate the community development processes, in concert with an institutional development process in the school setting, is a research agenda with substantial Health Promotion policy implications for addressing the social gradient of health.

Making a commitment to further investigate the concepts and methods that enrich understandings of physical activity from a Health Promotion perspective is imperative to theoretical development. Cross sectional investigations of more numerous and diverse schools with food garden programs are suggested. Every opportunity should be taken to conduct such work in schools that present comparative opportunities. One imagines the physical activity of a school food garden in an asylum seekers detention camp will be serving a very different purpose to that in the electorate of a Prime Minister; the question is whether the concept of physical activity from a Health Promotion perspective will be changed. In structuring terms the similarities of these diverse contexts would prove to be as informative as their contrasts, both providing quite powerful explanatory challenges to theory and the two models developed in this case study.

Varying both the programs and communities in which investigations are conducted is suggested for future research. This case study was conducted in primary schools with a

food garden program; as previously explained introducing this thesis, a different program context might have been selected, assuming it complied with the design criteria of this case study. The primary school context introduces a limitation; these communities are generally, but not exclusively, determined by tight geographical boundaries and characterised by parental oversight, if not direct involvement. It is recommended that school food garden programs conducted in secondary or tertiary settings be investigated. These studies should challenge both the geographic clustering and the influence of adult presence on the social dynamic.

Choosing to study the physical activity of a program other than school food gardening would challenge limitations associated with a program predominantly conducted out of doors. In a primary school setting, alternative school programs might include dramatic or creative arts or band programs. Alternative school Health Promotion programs might include a school's anti-bullying program or a chronic disease self-management program. In a high school or adult school setting, alternative school programs such as off-campus learning programs (so-called City Experience Semester), Vocational Education Training or taking of correspondence courses might be suitable for investigation.

In the current atheoretical void, school physical activity is studied in specific spaces. This problematic practice is partly a result of ecological concepts in behavioural approaches to physical activity and proved to be a limitation of this study. Studies monitor volume and intensity characteristics of children's physical activity during school breaks (Parrish et al., 2013; Stanley, Ridley, & Olds, 2011) and show high variability during class times (Erwin, Fedewa, Beighle, & Ahn, 2012; Fairclough, Butchera, & Stratton, 2008; Gregory et al., 2012). These are highly selective places; studies of the physical activity of libraries, bus shed, canteen areas, disciplinary classrooms, teaching staffrooms or private areas are unidentifiable in peer-reviewed journals. Sectioning school spaces presents a selection of children's physical activities as the whole of physical activity in the school setting. Spatially partitive research selectively informs a concept of physical activity for Health Promotion settings. In future it is recommended that research designs, especially for HPS, include all the activities of daily school life and recognize the influence of specific spaces in a setting from the full range of options.

The Structuration Links and ReInterplay Models have potential application in many organisational settings, especially those characterised by hierarchical structures such as corporate environments. While the suggestions for future research have been presented for the school setting, each has equal relevance when adapted for application in these other institutional environments. The models and concepts of physical activity from a Health Promotion perspective need to be challenged in diverse institutional settings in order to test any assertion of translatability or entitlement to representation as a general theoretical abstraction. These models present opportunities to guide and direct the public policy process. If they are to be recommended for such a policy application, there is an ethical imperative to ensure this tool is effective and capable of positive effect on structuring setting health.

It is an assumption of this study that physical activity has a unique embodied relationship to the activities of daily life. A slightly more esoteric view of future research should include investigation of other embodiment outcomes using the models. Researching subjective rationalities relating other embodiment outcomes to health are needed to challenge the premise that physical activity is a unique tool through which to investigate structuring of society. Perhaps it is not. The health outcomes from garden physical activity delivered a simple and comprehensive typology. Participants' rationalities from other embodiment outcomes, such as language acquisition for example, might offer other insights into the 'underlying codes' of social structuring.

The centrality of community accessibility in developing Health Promotion theory emerged and strengthened during the conduct of this study. Claiming to support and enable people to develop an essential voice in healthy living without the direct involvement of communities and their members cannot remain a practice that is undertaken in the name of Health Promotion. Sharing power with people themselves in reoriented health services can no longer be modelled as an optional feature of Health Promotion initiatives. Policy initiatives and advocacy to counteract harmful products and practices must be the outcomes of people who have invested in the local and personal interactions that are structuring society. Health Promotion theory must be equally for the benefit of those people. The ethic of Health Promotion expressed in the pledges of the Ottawa Charter is definitive of this discipline, profession and practice. It must be definitive in the development of Health Promotion theory.

Finally, studies with theoretical objectives are limited by the state of the theoretical traditions that precede them in the discipline of interest. By far the greatest limitation on this study is the relatively undeveloped state of Health Promotion theory on which to found theoretical work. It could be argued the newness of considering physical activity from a social theory standpoint and the breadth of ground to be covered just to connect the few dispersed manifestations of the intellectual base are a limitation of all academic endeavours in this area. Even at the conclusion of this study, the state of theoretical development in Health Promotion remains only infinitesimally further progressed. With such a broad front, forward progress is necessarily slow. Of particular importance to the participatory application of the models is the further theoretical consideration of power and empowerment, especially as it relates to the objective of creating more accessible theoretical tools (Giddens, 2009; Lukes, 2005; Spencer 2014)

A comprehensive conceptual review is needed of methods and methodological approaches that have previously been used to investigate physical activity. This review should posit methods and approaches that could potentially be used in the future to investigate physical activity for Health Promotion purposes. The analysis in such a review should include discussion of the manner in which physical activity has previously been conceptualised as a setting health outcome and present a vision of physical activity for Health Promotion in the social and institutional contexts anticipated as the social realities of the near future.

To conclude, this section reviewed limitations and future directions of this present research into school setting. Implications of the findings for Health Promotion in other institutional settings were discussed. This has been a necessary discussion, not simply to draw the thesis statement to its conclusion, but also to gather courage for the inevitably slow advance of Health Promotion's theoretical base yet to come.

7.4 Recommendations

Three findings from the current case study have implications for theoretical advances to school setting Health Promotion. They are an articulation of a Health Promotion perspective of physical activity, creation of the Structuration Links Model and its incorporation into the ReInterplay Model.

This study recommends further conceptualising of physical activity from a Health Promotion perspective be undertaken in a wider variety of settings with fundamentally different social interactions. Each of the seven contextual factors identified in this study - transience, biophysical, social dynamics, time course, adult presence, purpose, physical autonomy - should be examined individually in populations of different ages and with different beliefs about physical activity and health. The concept of physical autonomy requires more conceptual work as regards the fundamental considerations of agency and free will.

This study recommends further investigation of Structuration Links Model to test explanatory power in other health outcome contexts. A larger study of physical activity of daily life should be conducted to further test the boundaries and over-laps of the Physiological, Contingent and Consequent outcomes. A consideration of the PIOTs of garden physical activity in populations of different ages, in different cultural context and with different beliefs about physical activity and health is recommended. Further contemplation and articulation of the relationship between interacting PIOTs is necessary.

This study recommends the ReInterplay model be realised in its virtual form and a participatory process of development undertaken with non-academic users. Application of the ReInterplay Model should also be trialled in other institutional Health Promotion settings. The application of the Structuration Links and ReInterplay Models to settings Health Promotion scenarios with sufficient scope to assess explanatory power at the local and institutional levels of Health Promotion should proceed. Application of the ReInterplay Model should address the development of HPS as a priory.

Finally, this study recommends other Health Promotion theorists should undertake further theoretical development of the Structuration Links Model and ReInterplay Model. This encouragement should extend to on-going theoretical development in all areas of existing Health Promotion theory.

7.5 Findings

This study finds that food gardens in schools have the potential to increase physical activity given realisable opportunities in attendance, timetabling and programming. General recommendations could not be made with an expectation that physical activity would necessarily increase at each site. Methodological and conceptual aspects of physical activity must be critiqued from a Health Promotion perspective and for their relevance to observation of activities of daily life.

Two advances to school setting Health Promotion theory were made using structuration and institutional development approaches. The first was the development of the Structuration Links Model from relationships found in typifying the participant identified health outcomes of the garden physical activity. The second was the development of the ReInterplay Model for the communication of the setting interactions in a multi-levelled institutional context. The models represent the duality of structure:agency as a momentary phenomenon that unifies with the passage of time in a perpetuating process. The ReInterplay Model positions the Structuration Links Model as structuration's 'underlying codes'. It positions cycles around the holons and levels of the IAD framework as structuration's 'surface manifestations'. These theoretical advances are demonstrations of possible uses of structuration and institutional development approaches to setting Health Promotion theory, especially for application in schools.

Food gardens in schools have potentials to increase physical activity. Structuration and institutional development approaches relate physical activity to the processes creating health-promoting settings. Community accessibility is a definitive feature of advancing Health Promotion theory.

APPENDIX A

STAKEHOLDER INTERVIEW SCHEDULE

Could you please give me an idea about what has been your involvement in the school kitchen garden program?

What do you think about having a kitchen garden in the school?

- What do you think it does for the kids/school community?
- What does it do for health particularly? Anything else?
- Thinking of the garden in the future , what would you change?

<<I have been thinking about the garden as a place for physical activity, and your comments have touched on that/not really mentioned that?

I was wondering if you have any ideas on using the garden for getting more physical activity?>>

- How should we judge success for the garden program?
- Is physical activity one of the items you would use? Why do you say that?
- What role do you think schools should have in health promotion?

What has been your involvement in the school kitchen garden program?

What do you think about having a kitchen garden in the school?

- What do you think it does for the kids/school community?
- What does it do for health particularly? Anything else?
- Thinking of the garden in the future , what would you change?

<<Thinking about the garden as a place for physical activity, and your comments have touched on that/not really mentioned that?

Do you have any ideas on using the garden for getting more physical activity?>>

- How should we judge success for the garden program?
- Is physical activity one of the items you would use? Why do you say that?
- What role do you think schools should have in health promotion?

APPENDIX B
LITERATURE SEARCH STRATEGY

The literature search conducted for this study was a progressive series of strategies to identify significant documents to inform the design, conduct, analysis and discussion of this mixed methods case study. The search was conducted over the period February 2012 to April 2016 using the resources of the University of Wollongong. A literature search protocol was developed at commencement and employed throughout this study to support good practice.

Initial scoping search strategies used keywords from the research questions and seminal papers at hand. A methodical process was used to develop a more comprehensive keyword list from the successful hits achieved in the scoping searches. Comprehensive searches of literature in the areas of school physical activity and the school food garden were conducted in June 2013. Successful strategies were repeated and placed on regular notification cycles.

The literature search also included search strategies targeting specific method, methodology and theoretical issues. Successive searches were conducted in response to emerging information needs in the design, analysis and discussion phases of the study. These search strategies were scoped through 'trial and adjustment' keyword searching of general databases and by following key citations, specific authors and specific theories in the previously identified school physical activity and health promotion theory literature.

This appendix will describe the literature search protocol used for all the literature searches in this study. It will provide detail of the process of identifying keywords for search strategies targeting the school physical activity and school food gardening and establishment of the on-going process to identify recent publications.

Literature Search Protocol

The literature search protocol opened with a description of the overall objective of the literature search, an overview of the search boundaries, and a short written background of the study area including a rationale for the research questions. The modus operandi of

the literature search for the study was described. Details were provided of the exploratory process to identify search terms, a methodical approach to searching online literature resources and the management of papers and citations identified by these searches. The protocol was a working document that was updated over the course of the study to accurately reflect the search practice.

Modus Operandi

A general search and initial analysis of the school physical activity and school food garden literature was conducted. This informed development of the research questions and the identification and choice of study methods and methodology. Thereafter, search and analysis of the literature was conducted in themes as issues emerged from the case study. These themes reflect the focus of literature review subsections in each chapter. The themes of Chapter 2 required a search strategy focussed on applications of the specific methods to be used in the study. Chapter 3 required a search strategy focused specifically on identifying previous accelerometry studies of school food garden physical activity and the measurement of school physical activity more generally. Chapter 4 focused on searching for publications discussing the relationship between method, methodology and the Health Promotion perspective. After an early scoping search that had informed the design of the case study, Health Promotion theory, structuration and institutional development were the focus of more targeted searches conducted for the analysis and discussion of Chapters 5 and 6.

Process for Identifying Keywords for Search Strategies

It was important to identify the most effective keyword combinations to detect publications in the study areas of school physical activity and school food gardening. Effective keyword combinations were the cornerstones of search strategies applied across the study. When searching strategies were developed for each chapter theme, these keyword combinations ensured the literature search remained methodical. The literature search process instilled confidence that methods used to measure physical activity in schools had been comprehensively identified. The literature provided both an insightful sense of their pattern and frequency of use and the opportunity to identify the breadth of health outcomes being attributed to the school food garden.

The exploratory keyword scoping searches were conducted in June 2012. The Medline database was searched using an initial list of terms drawn from key words in the research question. The terms of gardening, school and children related with the Boolean operator AND returned 28 hits. A search strategy that included school, children and physical activity returned an excess of hits.

Medline		
1	gardening.mp. or Gardening/	
2	school.mp. or Schools/	142014
3	children.mp. or Child/	1461501
4	1 and 2 and 3	28
5	1 and 2	44
6	5 not 4	16
7	1 and 3	112
8	2 and 3	69001
9	8 and physical activity.mp.	2330
10	4 and 9	7

Table 1 Initial scoping search of Medline showing search nominal, strategy and hits

This scoping search strategy was then applied to five online databases to produce a collection of approximately 390 publications when duplications were removed. Details of these searches are shown in Tables A.1 to A.5 The hits from these scoping searches were then evaluated at the levels of title, abstract and full-text sifting. This reduced the number hits to 55 key articles. Keywords of this set of selected articles were added to the list of potential keywords.

Cochrane (Wiley)		
	ID Search Hits Edit Delete	
	#1 (gardening) 316 edit delete	
	#2 (children):ti,ab,kw 61062 edit delete	
	#3 (school):ti,ab,kw 9235 edit delete	
	#4 (gardening and child and school):ti,ab,kw 3 edit delete	
	#5 (gardening and child):ti,ab,kw 12 edit delete	
	#6 (gardening and school):ti,ab,kw 4 edit delete	
	#7 MeSH descriptor Gardening explode tree 2 7 edit delete	
	#8 (garden* and child* and school) 56 edit delete	43 Cochrane reviews, 2 other reviews, 8 trials, 3 Cochrane groups
	#9 (garden* and child* and "physical	

	activity"):ti,ab,kw 1 edit delete	
	#10 (garden* and physical activity):ti,ab,kw 8 edit delete	
	#11 (garden* and Child* and school and physical activity):ti,ab,kw 0 edit delete	

Table 2 Initial scoping search of Cochrane (Wiley) showing search nominal, strategy and hits

Web of Knowledge		
9	#6 AND #1	11
8	#6 AND #5 AND #3	17
7	#6 AND #4 AND #3	34
6	TS= (physical activity)	115,767
5	TS=school*	301,481
4	TS=child*	1,051,997
3	TS= (garden*)	29,005
2	Topic= (garden* and child* and school*)	11
1	Topic= (garden* and child* and school*)	132

Table 3 Initial scoping search of Web of Knowledge showing search nominal, strategy and hits

Proquest		
garden* AND "physical activity" AND ("physical activity" AND child*) AND ("physical activity" NOT adult AND child*) NOT women NOT cancer NOT men		
1	garden*.mp.	1731
2	child*.mp.	517200
3	school*.mp.	310662
4	physical activity.mp. or exp Physical Activity/	24498
5	1 and 2 and 3 and 4	4
6	1 and 2 and 4	8
7	2 and 3 and 4	1389
8	7 not teen*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1360
9	8 not adol*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1005
10	9 not disease.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	957

11	10 not disability.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	938
12	11 not autism.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	926
13	12 not disorder.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	886
14	13 not injur*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	870

Table 4 Initial scoping search of Pro Quest showing search nominal, strategy and hits

PubMed		
8	((#3) AND #4) AND physical activity	37
6	(#5) AND #4	1142
5	school*	1956672
4	garden*	12201
3	child*	1779711
2	garden* and child*	1
1	garden* and school* and child	

Table 5 Initial scoping search of PubMed showing search nominal, strategy and hits

Keywords from articles at hand

The next stage of the process to identify potential keywords involved searching an existing library. A comprehensive collection of gardening literature had been created in the course of evaluating an Australian food gardening program. This collection was subjected to a full text search, using the preliminary keywords and operators “physical activity” OR exercise OR fitness. The key words for hits from this source were themed and added to the list of potential keywords (see Text Box B.1)

Text Box B.1 Keywords from Search of Kitchen Garden Program Evaluation Library

Public Health Issue

Children's health, chronic disease, DETERMINANTS, Education, EDUCATION, SCIENTIFIC DISCIPLINES, ENVIRONMENTAL-INFLUENCES, epidemiology, Ethics, Food, health, health development, Health education, Health knowledge, Health Promotion, Knowledge, Lifestyles, nutrition, Nutrition education, OBESITY, physical activity, Physical fitness, place, PLANNED BEHAVIOR, rural health, Social responsibility, Society, SUSTAINABLY PRODUCED FOODS, Vegetables, weight

Applications

Agricultural Economics, Agriculture, AGRICULTURE, MULTIDISCIPLINARY, Child Nutrition Sciences - education, Curricula, Diet, Dietary habits, Educational intervention, Exercise, Exercise - physiology, Experiential learning, food behavior questions, Health Promotion - methods, health promotion intervention, Informal learning, INTERVENTIONS, natural environment, natural world, obesity prevention, Outdoor activities, Physical Education and Training - methods, place makers, Prevention programs, primary education, Program evaluation, School gardening, school program, Special & Remedial Education, Special Education, Teaching , Teaching Methods, VEGETABLE CONSUMPTION

Outcomes and Measures

Best practices, Children's perceptions, ENERGY-EXPENDITURE, environmental awareness, healthy eating, healthy lifestyle program, questionnaire, questionnaire development, RECOMMENDATIONS, SCHOOL CHILDRENS KNOWLEDGE, survey

Settings

After school programs, CARE CENTERS, Community gardens, Elementary school, gardening, Gardens, Inner city, International garden project, kitchen garden, SCHOOL, School based programs, school garden, school ground

Population

ADOLESCENTS, children, children and adolescents, Human Childhood (birth-12 yrs.), Inner-city youth, Preschool, Preschool children, School children, YOUNG-ADULTS, YOUTH

A second series of scoping searches was conducted in general databases drawn from the list of proposed databases. Keyword combinations were trialled to evaluate the

relevance of hits to the specific context of school physical activity and the school food garden. Keywords on the effective list were stratified to reflect increasingly diverse health outcomes within physical activity interests (see Text Box B.1).

Text Box B.2 List of Keywords Reduced by Scoping Analysis of Search Hit Outcomes

Principle Strategy

Child*, Exercise, Physical, Activit*,Garden*,School, Fitness

Potentially Useful Additions

Youth OR Adolescen*

Education OR Teach* OR Learn* or Curricula

Health* OR Prevention

Obesity OR Overweight OR weight OR energy expenditure

Place

Sedentary behaviour OR Lifestyle*

Questionnaire OR Survey OR Epidemiology OR Best Practices or Interventions

Social behaviour OR Social Behaviour

Agriculture

Determinants

Disease Evaluation Questionnaire OR survey OR epidemiology OR best practice OR intervention OR Evaluation Health OR prevention OR obesity OR overweight OR weight OR sedentary OR behaviour OR behaviour OR lifestyle OR chronic OR Disease School OR Education OR Teach* OR Learn*OR Curricula Prevent* OR health* OR obes* OR weight OR energy expenditure

Draft search strategies were cross-referenced to a collection of literature at hand. Through the early stages of literature searching, approximately twenty-five key articles and abstracts had been identified consistently from the initial scoping searches and other less systematic approaches to the literature. Additionally, several key reports had been recommended from consultations with learned academic colleagues. Search terms were constructed from the list of potential keywords and run in the five general databases previously used. All key articles were present amongst the hits. The reports were identified from Google and Google Scholar; these were added to the search strategy.

The guide to Medical Subject Headings in the Medline database was consulted to judge the efficacy of the above process and did not identify further related terms for the population, outcomes or context elements. A consultation with the University of Wollongong Outreach and Liaison Librarian added a professional assessment that the coverage of the literature search was sufficient. At this point the literature search protocol was updated.

Potential data sources identified.

Having identified the keyword combinations, development of the search strategy turned to the database sources to which the search statements would be applied. A list of data sources was compiled. The first entry was the existing literature collection of the national evaluation project . On-line databases noted in the combined Public Health and Education Study Guides on University of Wollongong Library Website were searched. These are listed in the Text Box B.3.

Text Box B.3 Databases for Search Strategy	
A+ Education	ProQuest Central
Academic Search Complete	PubMed Central
AED - Australasian Education Directory,	SAKGNP Evaluation Collection
AMI - Australasian Medical Index,	ScienceDirect
Cochrane Library (Wiley)	ScienceDirect (Sciverse)
Education Research Complete	Scopus
ERIC - Education Resources Information Center	SocINDEX with Full Text
Informit databases	Taylor & Francis Journals
Informit Health Collection	Web of Science
MEDLINE with Full Text	Wiley Online Library

Search strategy

Each database in the search protocol was accessed, the date of each search noted and details of search statements applied for each search recorded. Duplication of databases was noted. References for hits in each search were downloaded to an EndNote (Thomson Reuters 2009) library file-complex for storage and management. Imported references were screened for relevance and duplication using the same criteria that had been used to reduce the list of references in the initial scoping searches (Text Box B.4). Copies of articles were attached in PDF form where available. If the PDF file was not

available for download and the title and abstract suggested the reference was a significant piece of work, documents were ordered through the document delivery service of the University of Wollongong library.

Text Box B.4 Selection of articles for School Gardens- All Health Outcomes or Physical Activity Outcomes	
Inclusions	Exclusions
All countries	Opinion or secondary papers
All dates	Physical activity is not an outcome
All methods	Preschool, adult, aged, institutionalised or disabled
All socioeconomic and ethnic groups.	Non peer reviewed
Children tending school gardens	English translation is not available
English language publications	Published prior to 1960
Full text available	Papers not available (on-line, document delivery)
Gardens in schools	No outcome listed
Males and females	Preschool, adult, aged, institutionalised or disabled

Peer reviewed journals, program evaluations	Community or private gardens not located in a school
Physical activity outcomes	English translation not available
School age children in any stage of education	Papers not available (on-line, document delivery)

Methodical Searches for Emerging Topics

Each chapter required a specific search strategy. Each search strategy had its own objective, overview and background. The search strategies for these chapter searches focussed on general databases as their data sources; specialist databases were consulted where information was not identified from general sources. The aims of each search strategy for the emerging chapter topics were articulated in working documents that began as replications of the literature search protocol. Citation searching was a particularly effective technique in finding literature on method and theoretical issues. Google scholar was also used for this purpose, as was Scopus. Papers in hand were used to identify the effectiveness of search strategies for emerging topics. The area of a Health Promotion perspective of physical activity was not able to be searched systematically and required a strategy of citation searching the use of EndNote to search the growing collection of articles in hand.

Search Strategies Translated Run Regularly

A second consultation with the University of Wollongong Outreach and Liaison Librarian was conducted to establish regular running of the most successful search strategies. These were established for the Cochrane Library (Wiley), Medline, Informit Health and Education Collections, ProQuest, PubMed, ScienceDirect (Sciverse) Taylor and Francis Journals and Wiley Online Library. Examples of the search strategies are listed below. A final search of the general databases was conducted on 1st August 2016.

Search Strategies Automated

Cochrane Library (Wiley)

All Text=1

"school garden" or "kitchen garden" or "schoolyard garden" or "farm to garden"

Title, Abstract Keywords=2

All Text=1 Title

Abstract Keywords=0

“farm to school”

MEDLINE

Peer Reviewed

"school garden" or "kitchen garden" or "schoolyard garden" or "farm to garden"

TX All Text=21

TI =8

SU=0

KW=0

AB=19

TX All Text “Farm to School” =5

Approach 2

Peer Reviewed

Youth OR Adolescent OR Child OR Children AND

garden OR gardens AND

school OR schools

All text =123

TI=2

AB=57

SU=2

KW=0

Informit Health and Education Collections

Approach 1

Education Databases

(child or children or youth) AND (garden or gardens or gardening) AND (school or schools) =0

"school garden" =4

"kitchen garden" =36

"schoolyard garden" =0

"farm to school"=1

Health Databases

(child or children or youth) AND (garden or gardens or gardening) AND (school or schools) =0

"school garden" =6

"kitchen garden" =13

"schoolyard garden" =0

"farm to school"=1

ProQuest Central

All fields no full text ("school garden" OR "kitchen garden" OR "schoolyard garden" OR "farm to school")=108

all ((child OR children OR youth OR adolescent) AND (garden OR gardening) AND (school OR schools))=404

PubMed Central

#13	((((((((school OR schools)) AND (garden OR gardening))) AND (child OR children OR youth OR adolescent))) AND gardening)) AND school	2051
#12	(#11) AND (child or youth or adolescent)	1348
#11	(#10) AND school	2051
#10	(#9) AND gardening	2051
#9	(#8) AND #5	8251
#5	(child or children or youth or adolescent)	594444
#8	(#7) AND #6	13047
#7	(school or schools)	774163
#6	(garden or gardening)	29578
#4	Add Select 2 document (s)	2 EXPORT DEMO
#3	(((child or children or youth or adolescent)) AND	8251

	(garden or gardening)) AND (school or schools)	
#2	Add Select 72 document (s)	72
#1	((("school garden") OR "kitchen garden") OR "schoolyard garden") OR "farm to school"	72

Pubmed25

(("school garden"[All Fields] OR "kitchen garden"[All Fields]) OR (schoolyard[All Fields] AND ("gardening"[MeSH Terms] OR "gardening"[All Fields] OR "garden"[All Fields]))) OR "farm to school"[All Fields]=72

Pubmed25b

(#11) AND (("child"[MeSH Terms] OR "child"[All Fields]) OR ("adolescent"[MeSH Terms] OR "adolescent"[All Fields] OR "youth"[All Fields]) OR ("adolescent"[MeSH Terms] OR "adolescent"[All Fields]))=1348

Pubmed25c

Search (((((((school OR schools)) AND (garden OR gardening))) AND (child OR children OR youth OR adolescent))) AND gardening)) AND school 2051

ScienceDirect (Sciverse)

541 articles found for: (ALL ("school garden" Or "kitchen garden" Or "schoolyard garden" Or "farm to school") AND LIMIT-TO (contenttype, "1,2","Journal")) and school

1,104 articles found for: ((ALL ((((((((school OR schools)) AND (garden OR gardening))) AND (child OR children OR youth OR adolescent))) AND gardening))) AND LIMIT-TO (contenttype, "1,2","Journal")) and school) and garden

35 articles found for: TITLE-ABSTR-KEY ("school garden" or "kitchen garden" or "schoolyard garden" or "farm to school") and school

Taylor & Francis Journals

> "school garden" Or "kitchen garden" Or "schoolyard garden" Or "farm to school"=940

Wiley Online Library

There are 282 results for:

> "school garden" Or "kitchen garden" Or "schoolyard garden" Or "farm to school" in Article Titles OR "school garden" Or "kitchen garden Or "schoolyard garden" Or "farm to school" in Abstract OR "school garden" Or "kitchen garden" Or "schoolyard garden" Or "farm to school" in Keywords

“School garden” title=16 abstract=61 keyword=11

There are 23 results for:

child or children or youth or adolescent in Abstract AND garden or gardens or gardening in Abstract AND school or schools in Abstract

Conclusion

The literature search process for this study was methodical comprehensive. It began with the task of identifying school food garden physical activity literature, of which there was little among the much larger areas of school physical activity and school food gardening. The theoretical interests of the second research question necessarily broadened the search. The case study methodology produced emergent issues that needed a responsive literature strategy. Automated searches in general databases ensured recent publications were available for consideration. Confidence can be expressed in the literature search process to have identified documents of significance to inform this study.

APPENDIX C
GARDEN SESSION DESCRIPTIONS

School One

Session One

It is 11.39am immediately after the morning break on Friday 13th September 2013 and time for the regular scheduled garden session. The students in the Stage 3 class arrive over the course of two minutes. As the group settles in the covered learning area (COLA), the school administrator makes a visit to the class. A student leaves with her, returning at a run two minutes later. The Garden Specialist joins the students, three parent volunteers and their classroom teacher. For the first minutes all receive their instructions and arrange themselves in four groups. Each group is accompanied by one of the adults. The classroom teacher is participating in the day but joins the Volunteer 2 group taking a more participatory leadership relationship to the students.

Volunteer 1 and Volunteer 2 take their groups to the field bed area. Volunteer 3 stays in the COLA with a smaller group of three students who work on a writing task. The Garden Specialist takes a group of seven students into one of the school buildings adjacent to the garden. They remain inside, out of the field of view, until a later return. One of these students (The Carer) takes the hand of the preschool child of Volunteer 3 and joins the Garden Specialist group indoors. For The Carer, the garden session is loosely spent re-joining the Garden Specialist group but predominantly gravitating back to the COLA and between groups. When at the COLA or in the vicinity of the other groups The Carer interacts with members of that group but does not remain.

Volunteer 1 and two students (Plough One and Plough Two) enter the field bed area with a human powered plough. One student (Plough One) commences to cultivate the paths between the beds as a form of weed control. The remaining three group members join; one enters, stands briefly, leaves and returns with the final two. They then stand waiting. Eventually, one of these students crouches over the garden bed and begins to weed. The remaining two stand waiting as before. Plough Two arrives with long

handled tools and begins to cultivate. Finally all the group members are working on the beds and paths. Each student, with the exception of Plough 2, joins the Volunteer 1 in weeding, getting down to the level of the garden bed.

Plough One stops sloughing, converses with the classroom teacher, then leaves the garden area with another student from the COLA group briefly. Plough One returns and retires, allowing Plough Two to take up the tool. This is done with great gusto. Plough One steps over the beds to obtain a bucket into which he begins to add weeds, crouching and weeding with the other group members.

Meanwhile the group working with Volunteer 2 arrives in the garden area. They stand and wait initially as there is a prolonged planning conversation between Volunteer 2 and classroom teacher. Three of the group leave, gather tools and return. Volunteer 2 and two group members remove the irrigation pipe that is staked into place in the garden bed they are about to prepare and plant. The group members are stepping over the beds, bending at the waist to remove stakes and wrestling to gather the unwieldy hose and relocate them out of the way. The group begin to plan out the bed, crouching. There is a subgroup forming around the classroom teacher.

In the Volunteer 1 group, ploughing is proceeding intermittently at a running pace by Plough Two. The plough is swapped back into the control of Plough One as Plough Two leaves for the tool shed returning with a new set of long handled cultivation tools. The plough is returned to the tool shed. Plough Two begins to disturb weeds between the beds on the pathway with the new tools. The remainder of the group are continuing the precise work of weeding between the plants growing in the beds they have been charged to tend. For the rest of the session there are frequent visits by the members of this group to the poultry run to throw the green weeds to the birds. Some of the journeys are taken by indirect routes and include a visit to another group's work site.

Hand tools have been distributed to the Volunteer 2 group members and they cultivate the soil, crouching, sitting and bending down to the height of the bed. The group members move from one location to the next along the beds sometimes performing little jumps to clear the beds and work on the opposite side. The work is interspersed with individuals walking between beds and relocating to sections of garden briefly for

purposes such as placing objects in the bin, weeds in the poultry run and other purposes that could not be discerned from observation.

Volunteer 2 leaves the field of view through the rear school gate accompanied by students from each group. At this time the Garden Specialist returns to the garden. It is 12.01pm.

The Garden Specialist group now has five members who arrive in the garden area with hand tools. Three pause to shell and eat peas from the established bed before reporting to the prepared bed they are about to plant out with seeds. Four students begin to cultivate the soil and mark planting lines. They are crouching, sitting and bending. They move between positions at the bed by walking on knees, waddling, shuffling without rising from a seated position or by standing to stretch and walk a few paces before sitting again.

The plough is brought out of the tools shed and cultivation of the pathway near the Garden Specialist group's bed begins. Seeding the bed is finished and all but the New Plough student leave the bed area returning from the tools shed with long handled cultivation tools. A member of the group who has been working with Volunteer 2 re-joins twirling a stick from a cut branch as a baton. Another of the group returns and uses a lawn rake alternatively as a crutch and a gardening tool to further dislodge weeds uprooted by the plough.

In the midst of the seeding at 12.17 pm, two students (Chooker One and Chooker Two) have a conversation with the Garden Specialist, leap and express excitement to each other before leaving to undertake tasks in the poultry run. These two students visit the tool shed for supplies and tools before starting to work in the hen house. Chooker One uses a broom to sweep out the house and Chooker Two attends to the feeder containers. Three children from the FV1 group are standing at the tap outside the hatch to the laying boxes and start conversing with the Chookers through the hatch. Chooker 2 is making a series of transitions between the hen house and the place in the garden where the Garden Specialist group is working. Chooker 2 leaves the poultry run, prunes Lemon Geranium branches off a pot plant in the vicinity of the Garden Specialist group. Chooker 1 cleans the food feeder. Chooker 2 returns and places the branches in the hen house. Chooker 2 leaves and repeats this process two more times. Chooker 1 meanwhile

cleans the outside of the feeding containers, replaces the mash, replaces the shell grit fills the water container and undertakes a series of tasks out of view of the camera in the hen house.

In the COLA The Carer can be seen conversing with the group who continue to complete their writing task. The Carer stands applying lift at the elbows of the Toddler augmenting the Toddler's jumps then helping the Toddler climb onto the bench and re-join the parent.

Volunteer 2 and the combined group of students return to the garden with branches that have been removed by the Grounds man from trees in another part of the school. The classroom teacher has been working with the remainder of the Volunteer 2 group, completing the cultivation. Other group members have moved to the established bed and taken on the task of tying growth to the support structure. Volunteer 2 returns and begins moving rapidly between the students planting the newly prepared bed and wanting to build the support structure. Two furrows are made in the cultivated bed and the group members begin to plant seedlings in them. These students sit on the path, obtaining seedlings from a tray. One of the students pays a skipping visit to the Garden Specialist group. Volunteer 2 joins the students engaged in the process of tying new poles fashioned from the collected branches to the growing frame supporting the established beds.

For the Garden Specialist group, the seeding of the first bed has finished and they begin planting seedlings in a second. The irrigation pipe is removed from the bed area, one student jumps down from the low retaining wall to drag the hose away against its memory. Group members return and the Garden Specialist makes a planting furrow in the bed. The group members set about placing seedlings in the furrow and settling them into the bed. One group member does not plant but travels to the tap and back with a watering can throughout this process, watering in the new seedlings and the nearby beds. There is a slow rhythm in the crouching, planting, standing and talking which occurs overlaid somewhat by a foreground of action from visiting students. This action includes intense short lived solos on garden tool air guitars, a vigorous and ultimately futile attempt to wobble two metal poles out of the ground and transitions across the top of the garden beds executed with challenge related inefficiency. The Carer and Pre-

schooler make a series of visits to the Garden Specialist group during this planting, bringing a watering can back and forth from the tap in the school buildings area. The Carer swings the Toddler over the beds in an assisted jump and they move off to refill their watering can.

Volunteer 2 continues to remove twigs from the branches that have been collected. The cleaned branches have been used to finish strengthening the support structure in the established bed. There are a number of students who are holding extra branches, some purposively, some showing no intention towards the branch in their hand and others employing the branches in what is obviously fantasy play and stylised war craft. For some students the session starts to break up with play.

The classroom teacher arrives with a student who has been her companion during the session; they consult the Garden Specialist and leave. There are a growing number of visits from stick wielding members of the Volunteer 2 group. The students begin to leave the garden area. The tool shed becomes busy with conversations, crossings, actions and relocation of objects. Finally the students leave for their classroom. It is 12.41pm

Session Two

It is 11.30 on Friday 11th November 2013. Two Pre-school children are marching purposefully around the beds in the food garden while their volunteer parent, who has just supervised the Stage 2 class, converses over coffee with a Stage 3 class volunteer. The children are whisked up at the end of their tour to leave just as the Stage 3 class starts. The class group arrives in the COLA over three minutes. When assembled three groups are assigned. At 11.40am the classroom teacher leads a group of seven students who have gathered quickly. They move off into the garden each carrying clipboards.

It takes more time to organize the other two Groups. The students are standing around the area adjacent to the COLA and tool shed. The class group is restless waiting. Several students can be seen shadow boxing while others are mulling around arranging themselves near peers. Two wander into the tool shed and garden area visiting the Teacher group before returning. Volunteer 2 stands near the rear school fence to create a spatial distinction between the Volunteer 2 group (the Stripping group) and the Garden

Specialists group (the Harvesting Group). The Stripping Group will begin by observing the Harvesting group, before the Stripping Group commence their task of removing the outer leaves off harvested garlic plants in the COLA.

Volunteer 3 remains in the COLA to work with students who present themselves over the course of the session. The Garden Specialist enters the broad field bed area where four garlic beds stand, each four meters long, 60cm wide. Two students are sent on an errand to retrieve others. Five students enter the garden, one more energetically than the others.

Volunteer 2 stands with the Stripping group. A student pushes an empty wheelbarrow closer to the garlic beds. Fork-wielding Harvest group members battle symbolically at the back of the group and others standing next to the beds begin to jump on the forks driving their tines in to loosen the dirt. They bend, lift the garlic and place it plant by plant in the wheelbarrow. One student from the Stripping group carries an armful of plants to the COLA tables. The Harvesting Group remain at this task while the majority of the Stripping Group go to the COLA with the plants. Several individuals move between the two sites repeatedly.

The Harvesting Group members begin throwing the garlic plants to Volunteer 2 rather than walk between one and a half and two meters to Barrow 1. One of the Harvesting students stands near Barrow 1 to help catch. Volunteer 2 takes Barrow 1 to the tool shed out of the sun.

Teachers group had moved to a bed at the far end of the garden. They are seen to stand with little movement, survey the bed and write responses on their clipboards. One member of the group crouches and returns to standing twice. At 11.55pm the Teacher group moves out of garden area and field of view in the direction of the classroom.

Volunteer 2 and a student push the school's ride on mower out of the tool shed and up towards the rear school gate. The Harvesting Group continues to lift the plants, levering the forks in the soil of the beds. They toss the harvested plants but now, in absence of the barrow, into a pile in the dirt. The full Barrow 1 is returned briefly from the tool shed, removed again and an empty one brought back to replace it. Piled garlic plants are scooped up and placed in Barrow 2. The Harvesting and Stripping Group members are

in motion. Harvesting, throwing, collecting fallen plants, moving barrows to enable better (and then more challenging) targets at which to aim throws, retrieving inaccurate throws.

Stripping Group members visit the bed area to collect garlic Harvesting Group members, who push a Barrow 3. The purpose of the Stripping Group members' journey is apparently to accompany the pusher of Barrow 3 to ensure their personal delivery of the load to the COLA. A second barrow has been filled and the bed is cleared. Three students stand throwing the remaining garlic into the barrow. The catcher at the barrow returns the tossed offerings and they hold a passing contest briefly. The members of the group stand and wait for the Garden Specialist to finish speaking about the financial contribution of garlic farming to the school food garden program economy.

A Harvest Group member returns from the COLA having been to the water fountain on the edge of the garden. Two students relocate to the second bed and begin to converse with the Garden Specialist. Barrow 3 is removed by one of the students. The same student returns Barrow 2. Two group members are dispatched by the Garden Specialist to the COLA to assess the progress of the Stripping group and encourage the return of the Harvesting Group members who have drifted away from their task.

Two students begin the harvest as others stand around. The forks have been discarded in the first beds. The harvest continues by hand, with students pulling the plants out of the soil without loosening it first. The harvesting is done bending from the waist and only occasionally do the students crouch at the second bed while they are sorting the spoilt plants from those which are to be stripped and planted for storage and sale.

Another full barrow is taken to the COLA. Students have been walking between the garden bed area and the COLA. Stripping Group members have been eating raw garlic and the water fountain has been visited by several of them. Of the four students who remain harvesting, one begins to fork aimlessly in the empty first bed. A wheeled bin is dragged over to the second bed for the spoilt plants. Two more students return to the garden. The composition has changed from the original Harvest group.

Volunteer 2 arrives with an empty wheelbarrow. The Harvest Group again reduces to two students. They are alternating between conducting conversation with the Garden

Specialist and harvesting by hand. The Garden Specialist continues to sort the crop with the help of the two remaining members and those who visit on occasions from the COLA. A student is dispatched to bring back more group members. The group grows to four but one is watching and then leaves. Two work. A third leaves for the COLA; one has been standing conversing with the Garden Specialist without harvesting. At 12.40pm the task is complete

Barrow is placed in COLA, emptied onto table. Second barrow arrives at COLA. More members arrive in COLA. Barrow 3 arrives after being emptied into poultry run. Stripped leaves taken to poultry run

At 11:55pm members of the Stripping group can be seen working around the table in COLA stripping leaves. Some crouch and sit to strip but most are standing moving around the pile on the table. Some group members are involved in moving barrows to the garden and back to storage. Two others undertake regular trips between the COLA and the poultry run carrying the stripped outer leaves. A group of students leave the COLA area periodically to take water from the water fountain at the border of the school yard and food garden area. At 18 Members of the teachers group return to join briefly in the activity of the COLA group then leave. The majority of the Stage three class members leave over the next two minutes from 12.15pm.

A member of the Stripping Group returns to tour the garden; another student composts the last of the COLA waste and sweeps the tables. All have left by 12. 24

Session Three

The Stage 3 class begins to arrive into the COLA at 11.34am on Friday 22 November. It takes one and a half minutes for the line to stream in behind the classroom teacher. The Garden Specialist and four volunteers are in the garden; a preschool child accompanies Volunteer 3. Volunteer 4 is already at work, completing tasks started during the earlier session for the Stage 2 class. Volunteer 5 and Volunteer 6 wait in the COLA.

Volunteer 6 takes two students (Barrel One and Barrel Two) to an area adjacent to the poultry run where a barrow, forks and shovels stand next to a half wine barrel decorative planter of herbs. They stand together as Volunteer 6 gives an explanation. Volunteer 6 leaves and the two students begin a short, futile but concerted attempt to

drag the full barrel. Abandoning their attempt they take up forks and begin to lift the herbs by levering on the rim of the barrel. As vigorous as their action is, the results are limited. Barrel One climbs up onto the barrel to apply leverage from a different angle, engaging body weight in a manner of postures. Barrel One and Barrel Two are occupied at this task for some minutes.

Volunteer 3 leaves for the broad field bed area with a group of four students soon after the briefing and group allocation. After standing for two or so minutes to receive instruction, two students start to wind up a five meter piece of twine which they recover from a bed while the other two students crouch and being to cultivate between plants with hand tools. The twine rollers finish the task, take up hand tools, crouch and begin to cultivate. At this time the Garden Specialist arrives in the garden with a group of five students including The Carer who is immediately joined by The Pre-schooler. The group stands waiting for instructions for a period of time; several students join and leave. One student takes up a long handled cultivator and starts to work a bed slowly, standing and clearing the weeds. Other group members leave to return with watering cans full of liquid fertiliser. The Carer and another Garden Specialist group member begin to play chasing with the toddler around the garden then settle to cultivate the weeds from paths between the garden beds.

The classroom teacher remains in the COLA in the company of two injured children. They sit at the large tables with another student companion. Presently two other group members enter the garden from a nearby school building carrying a plastic tub full of stripped and drying garlic ready to be plaited for storage. The teacher and three of the students in this group remain in the COLA for the entire class. The two students, who had arrived with the garlic, return twice to the building during the course of the session carrying an empty tub and returning with it full again.

Volunteer 5 emerges from the Poultry run joined by three students- Chooker 1 and two others who begin to engage in conversation with Barrel One and Two. Another group of four students moves with Volunteer 5 to the compost pile with forks and spades. On their arrival, which was a brisk walk transit, one student climbs into the compost station and strikes a pose, another stand at the base of the station without a spade and begins poking the pile deep in conversation, the third thrusts a fork into the material and begins

to transfer fork loads from one compartment of the station to the adjacent one. The fourth student goes past the compost station to weed around the poultry run, using a fork to break up the soil and bending at the waist to pull out the grass clods. The fork-wielding student at the compost heap makes a study of moving the handle of their implement backwards and forwards. There is some repositioning of group members. One student jumps from the station twice before making attempts to balance on the tines of a fork. Two group members, encamped in the compost station with forks, remain for the entire session while the third moves off after approximately seven minutes to move between groups, beginning with the group in the poultry run.

The groups of the Garden Specialist and Volunteer 3 who have been working the garden beds have dispersed to visit, collect tools and refill watering cans with liquid fertiliser. Three remain at their tasks of cultivating after 15 minutes.

Barrel One and Barrel Two continue digging, commenting on the performance nature of their actions for the camera. Both abandon their task and runs to the company of Volunteer 4 in the bed area of the garden behind the tool shed.

Water is taken into the chicken run from the tap outside the run but immediately adjacent to the nesting boxes. Barrel One and Barrel Two begin digging the soil from the barrel into a barrow. There is a substantial amount of visiting behaviour between the Chookers and the Barrels, however Chooker 1 is diligent in filling the feeder and shell grit containers. Three students remain inside the poultry run with Volunteer 5 removing vines from the mesh fence.

The barrel is empty of soil and Barrel One attempts to drag it. Minibeasts are discovered beneath the barrel. Slaters are offer to the camera. Water is sprayed from off camera and a hand emerges into the field of view. The observation of mini beasts lasts for three and a half minutes and stimulates a wave of visitations from the COLA and Chooker Groups.

Eventually the barrel is flipped onto its side and Barrel One and Barrel Two begin to roll it to the new location in the garden under the direction of Volunteer 4. This is a task done with much lifting and struggling over the course of almost three minutes. Barrel

One leaves the barrel rolling to Barrel Two and relieves Volunteer 4 of pushing the barrow of soil and retained herb clods.

At the poultry run Chooker 1 continues to tend for the chickens. One of children from the Garden Specialist Group arrives with a bucket of weeds. One of the Chooker group tours the poultry run accompanied by a garlic-eating visitor from the COLA group.

The Carer, Friend and Pre-schooler can be seen playing in the area between the beanpole 'tepees', swinging the toddler into extended jumps while holding each of the toddlers hands. They begin a game of Ring a Ring a Rosie and fall down twice before moving back in the direction of the Garden Beds. They return to the Compost Group to visit.

The Chooker group has dispersed. Volunteer 4 continues on task. One Chooker Group member visiting the COLA observes the escape of the flock through the open gate and herds them unenergetically back into the coop. Chooker 1 arrives back at the poultry run carrying branches that have been pruned from fragrant perennials in the garden. One of the Chooker Group appears to have taken leave of this association is more constantly in the company of Barrel One and Barrel Two or walking back and forwards between the COLA, the Compost Group and the Garden. Another barrow of weeds arrives from the Garden Specialists Group.

Students have returned to the bed area. Three continue to cultivate, four begin to engage with the camera. Barrel One and Barrel Two are conversing and assisting Volunteer 6 with stabilising the barrel. Students from the Poultry group walk between the weeding and the poultry run carrying handfuls and buckets or pushing a barrow of weeds.

Two students continue to be encamped in the compost station with their forks, two engage in dodging behaviour; two others standby. The Carer arrives on the outskirts of the action holding the hand of the toddler. The compost group member (The Friend) who has been weeding the poultry run fence, takes part in some dodging, joins The Carer taking the other hand of the Toddler and leaves the compost area to visit for the remainder of the session.

The Carer and Friend return to the Garden Specialist group with Toddler and remain cultivating in the garden bed. A student takes weeds to the poultry run. The former

compost group member leaves the Garden Specialists group to visit the Poultry run group. Barrow One and Barrow return to help plant the barrel. Four students from different groups observe the chickens through the hatch of the laying box, while three students experiment with eating chicken feed. One of the experimenters leaves to visit the compost group.

Thirty minutes into the session and the COLA Group continue plaiting garlic and three students are at work cultivating in the bed area while others visit. Chooker 1 continues to return to bed area to cut branches for the laying boxes. In the Compost Station three students, one who has joined from the Garden Specialists group, are standing in the pallet size space of one of the compartments of the Compost Station. All three attempt to use garden forks; one student jumps down from the pile to stand outside the station. The compost in the compartment is moving but the pace is not fast. Two stand talking and singing, the third is twirling a spade like a baton. Volunteer 1 arrives and is soon accompanied by Barrel One and Barrel Two. A poultry run group member arrives and Volunteer 5 encourages the group to finish. The three with implements increase their work rate. Barrel Two arrives and several students move out of the field of view in a game of chase. Barrel One and Two return to view with Barrel One bouncing a soccer ball repeatedly on the head of Barrel Two.

The Garden Specialist arrives at the compost group at 12.10pm. Of the two encamped Compost Group, one continues to move the pile while one is poking and conversing. All but three students leave the compost area. The rate of movement of the pile increases. Chooker 1 returns to the garden with other Garden Specialist group members at a pace. The Garden Specialist returns to the garden. All the students who have been standing and squatting in the bed area gather tools. The Garden Specialist leaves for the COLA. One student carries weeds to the poultry run.

The Teacher leaves the COLA at 12.16pm and students begin to stream after, leaving the garden. Two students run from the COLA to the water fountain, tumbling on the grass in a boisterous game of tag. The Compost group returns to the COLA. Tools are unhurriedly returned to shed by remaining students. One student straggles from the garden using the crutches of one of the injured children. Two students remain plaiting in the COLA and are the last to leave the garden area at 12.31pm.

School Two

Session One

At 1.56pm on August 1st 2013 the Garden Specialist stands waiting for attention at the blackboard hanging on the raised garden perimeter fence. She begins a presentation about the water cycle having been thwarted in her original lesson plan by the cloudless sky. The class are standing, with the exception of two children; Crouching Child is leaning on a pole and Sitting Child is sitting on a trestle table at the back of the class group. One child goes to the raised garden fence to read the rain gauge located there. Hands are raised. Crouching Child sits next to Sitting Child. Sitting Child stands, joins the group, and soon returns to half sitting by leaning on the trestle table. Crouching Child returns to his pole. Another child drops to the back of the class and leans. The main group are still and their attention is directed at the blackboard.

After 15 minutes the Garden Specialist relocates herself to a table at the back of the COLA laid out with the session materials for making terrariums. The group forms a semi circle around her. A child from another class walks through the group to deposit into the compost pile. Movement in the group is quite curtailed and all are standing without leaning. A child joins the class late. Sitting Child steps back from the group and resumes half sitting on the trestle table. The Garden Specialist gives the order to commence and group members begin to walk around the perimeter of their own semi circle, gathering materials from different places on the Demonstration table. They disperse themselves around trestle tables that are located under the COLA and in front of the Compost heap.

By 2.20pm the group are well into the construction of their task. They share materials and this requires them to move from one site in the COLA to another and then return to their original location. A child from each pair group moves to collect masking tape from the classroom teacher standing near the blackboard. All movement is being undertaken in the area of the COLA and adjacent compost piles. Some of the early finishers challenge themselves to jump and touch the COLA roof. Shoving and wrestling starts between two pairs of students and the classroom teacher calls for the whole group's focus The children place their class projects on a table and move off to the next activity. The group gathers at 2.33pm near the school boundary fence around a fruit tree.

Stragglers run to join the group, one after two minutes, two after three minutes, the last re-joins the group after four minutes.

For the next activity the group gather to stand in a semi circle around a single deciduous fruit tree. The Garden Specialist demonstrates the use of a long-pole pruning device with a rope-operated handle. Nominated children are permitted to operate the device in turn. There is very little movement in the group, and three children find planter boxes against which to lean. The group return to the COLA exiting through the orchard in the company of the classroom teacher, collect their terrariums and return to class. Most of the children return directly to class with the classroom teacher however six others remain behind and return more slowly after their turn operating the pruning device. The school bell sounds at 3pm and buses are seen leaving. The Garden Specialist finishes pruning the fruit tree using the hand secateurs before returning them with the long-pole pruning device to the tool shed.

Session Two

It is 1:58pm, just after lunch break, on 15 August 2013. The time-lapse camera is vision capturing the garden from a place near the school boundary fence. Tripods supporting camera are located at points around the garden. The Stage 3 class are assembled in the garden under the COLA ready to start their fortnightly garden session. The COLA is the size of a double carport and has been furnished with three removable trestle tables. The Garden Specialist has prepared a lesson on a blackboard that hangs on the raised beds garden fence just outside the COLA roof. The classroom teacher stands slightly off to one side of the class but still part of the group. All the children are standing attending to the commencement instructions of the Garden Specialist. The Garden Specialist starts the session with a presentation of the water cycle from the science curriculum.

The class stand in one bunched group. One child at the back of the group crouches briefly, drawing the attention of the class teacher. The teacher approaches Crouching Child in a meandering fashion and words are exchanged between them calmly. In the group, hands are being raised but the majority of children are still. Time passes, some of the children are shifting their weight. Dancing on the spot. Rocking and pacing. Ten

minutes into the session the whole group consists of children ‘wavering’ to more or less an extent. Seen in 8x speed the image shows the physical stillness of the group decay over this first period into fidgeting, red hats on heads begin a pulsating motion that grows progressively. There is no physical activity so to speak, the children are standing and their movement in general does not translate to walking as much as shuffling.

It is now 2:14pm the children move to tables and receive procedural instructions from the Garden Specialist for their experiment task. The classroom teacher distributes materials as the children receive more instructions from the Garden Specialist. The children are attending as they did in the presentation but their movement is now twitchy, they are moving materials around on the tables in front of themselves. The class begin the experiment that has been described to them and their physical activity surges without becoming moderate in intensity. Working in small groups around tables in the COLA, several children can be seen moving to the front of the COLA to retrieve materials. One group, which includes Crouching Child, becomes more inert than during the instruction period and receives prompting from the classroom teacher. The Crouching Child moves from the table, standing away from the group and balances on a piece of wooden garden edging while waiting for materials to be delivered by the classroom teacher.

For the next five minutes activity continues around the tables. Occasionally children move to the front of the learning area and relocate materials. Crouching Child leaves the COLA and moves into the bed area (4 metres) and is followed by the classroom teacher. They return. At 2:22pm the task is completed and the Garden Specialist returns to the blackboard to give an explanation of the next task that is to pot seedlings to be raised in the seedling cupboard away from frost. The group begins the planting task by collecting materials, all of which are located under the roof of the COLA. Two students have been allocated the task of scooping compost into small pots and they stand at the compost heap immediately outside the COLA. Several students leave the field of view momentarily retrieving watering cans. Crouching Child progresses the balancing diversion of earlier and begins walking along the edging. Other children are placing seedlings in pots at their group table before relocating them to the seedling cupboard.

One child wanders in to the compost area; the teacher approaches. The student returns to the COLA. A number of the children begin to wander between tables. The Garden Specialist calls for the class's attention at 2:34pm. Children gather in a semi circle around the Garden Specialist and jostle for a place. Crouching Child walks away from the gathering and returns without prompting. Six minutes later after 42 minutes of the session the class sing farewell to the Garden Specialist. They form two lines and take the 250-metre walk to their class. At 45 minutes the children are out of sight of the garden with the exception of one child who had remained to tend the rain gauge. That child is seen leaving in haste to catch up with the rest of the group.

Session Three

The Garden Specialist is standing out the front of the class waiting for their attention at 1.56pm on 29 August. Hands are raised; all the students are under the COLA. One child walks to the blackboard and scribes. Another removes windblown rubbish from the group return it to the materials table. Several of the children are crouching and standing; the rubbish is recovered again. The group is loosely dispersed and the n moves to a place closer to the Garden Specialist All under the COLA. A different student retrieves the wind blow n rubbish. Children shuffle, rock and shift weight. They press one foot onto the adjacent ankle and stretch their quadriceps. At eight minutes the Garden Specialist relocates and the group form a crude around the table. Crouching Child moves behind the group and calls for comrades. He moves to another table. Classroom teacher issues an ultimatum directly and quietly to Crouching Child. The table is being used to describe strata clouds and the water cycle. Another adult withdraws a child. Another begins a hole from a crouch with a short stick. Crouching child moves forward and backward from the group remaining under the COLA. At 1.59pm the group moves to trestles working in place. At 2.13pm a child leaves the field of view and returns moments later. There is very little movement between tables for this task. After six minutes the child returns, then moves to a new location 20 meters away in the broad field bed area.

At 3.20 the group relocates to a plot of ground where two wheelbarrows have been prepared. The Garden Specialist arrives and the children stand around in a circle around a bed. A pair wrestles briefly. Sitting child sits in the wheelbarrow. Children relocate

near to the GGS Children are given a seed potato each and they are asked to place a potato in the circle bed. Each child has received a potato each child has crouched to plan it. Crouching Child drags a large woven poly bag four meters. The group forms a semicircle on the windward side of the bed. A child helps the Garden Specialist empty the bag of dry leaves over the bed. Children fall into the gap in the lee side and are asked to relocate themselves to the semicircle on the windward side. Five children help empty the leaves out of the very large bag. Half the group begin to stomp at the leaves before being arrested by the classroom teachers call for order and attention to the Garden Specialist instructions. The leaves are kicked back into the centre of the pile. Children stand in a tight semi circle and add fertilizer by passing around the limited resource. Finally after more standing the children move handfuls of spent straw from the wheel barrows that have been located two meters away from the beds by two children. The straw is place over the leaves with much crouching and tossing of straw onto the new potato bed. Sitting Child rolls the barrow while the rest of the group listen to their next set of instructions. The group leave the garden at 13 minutes; two girls exit via the orchard path and are seen around the poultry run before running back 90 seconds later to join the group in the COLA.

At 15 minutes the group returns to the COLA for final instructions and leave the garden at 18.30 minutes. Four boys linger to discuss a request for drums the Garden Specialist has just mentioned. They move off slowly and the garden is empty by 19 minutes.

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